SCIENTIFIC AMERICAN

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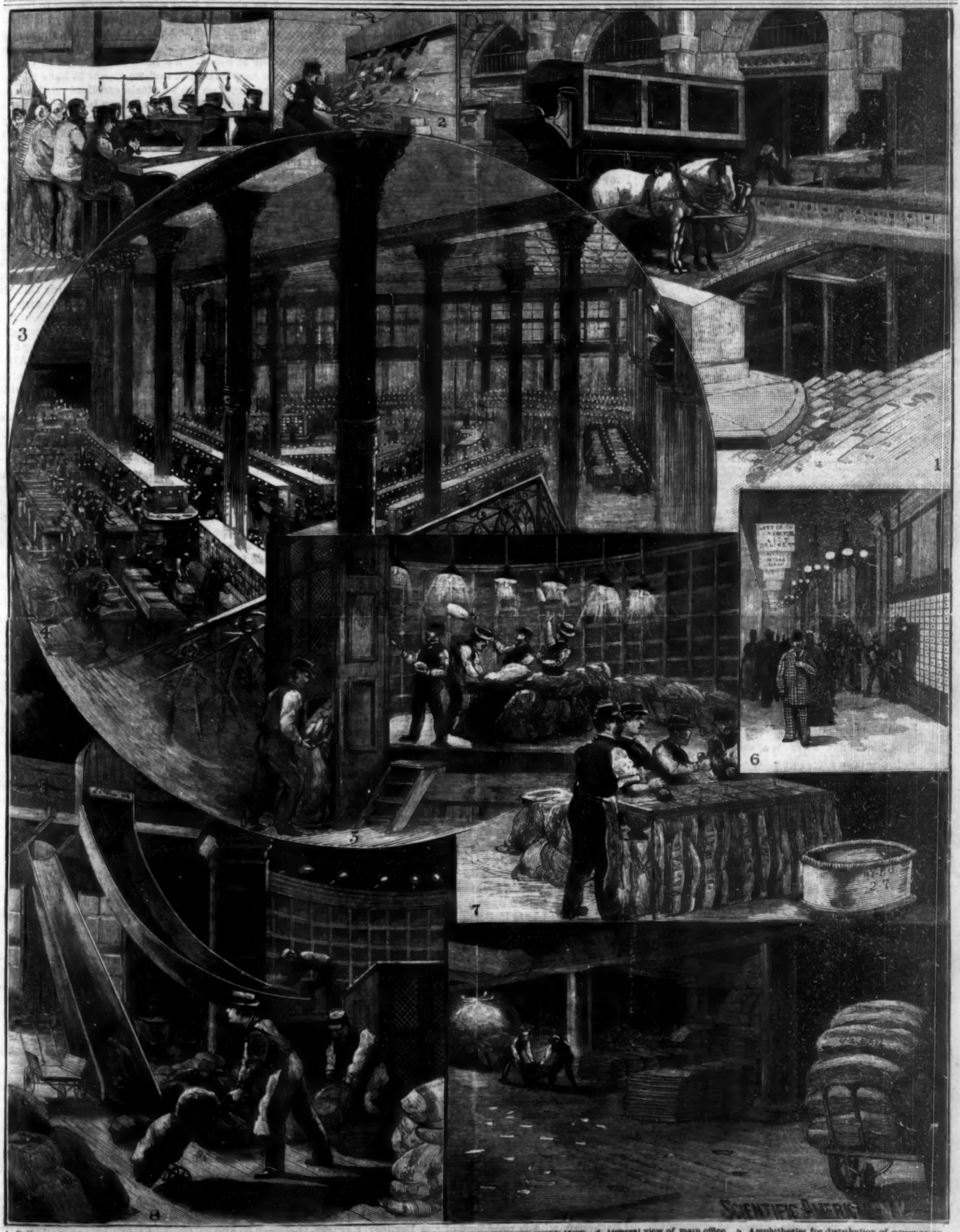

1. Delivery of sacks and pouches for outgoing mail. 2. Interior of city drops; facing up letters. 3. Carriers' and stamping clerks' room. 4. General view of main office. 5. Amphitheater for distribution of newspapers. 6. Corridor and private letter boxes. 7. Separating newspapers for city delivery. 8. Newspaper and bulk mail chutes. 9. Storage room for empty bags.

THE NEW YORK POST OFFICE.—[See page 55.]

Scientific American.

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NEW YORK, SATURDAY, JANUARY 25, 1890.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 734.

For the Week Ending January 25, 1890.

Price 10 cents. For sale by all newsdealers.

SAFETY IN ELECTRIC LIGHTING.

In this city the Board of Electric Control has removed from the poles many dangerous electric light wires. The temporary result is to reduce the illumination of a large portion of the city to the weak glimmer of gas lights, but the public is relieved from the daily occurrence of those shocking tragedies by which many lives were lost.

Another source of danger still remains, greater perhaps than that of the old overhead light wires; we allude to the electrical subways. In efforts to effect the removal of the overhead wires, the city authorities constructed beneath the surface of the streets a system of electrical conduits, called subways, designed to receive the electric wires. These subways now run through the principal streets, and so far no mode has been devised for preventing the infiltration within them of the escaping gas from the gas mains. It is well known that ten per cent of the contents of these mains escapes into the adjacent earth. This gas finds its way into the electrical subways, where it accumulates and forms an explosive mixture large in volume, which is ignitable by the smallest electric spark. The result is a frightful explosion, which tears up the pavements, scattering stones and iron in all directions. Four of these explosions lately took place in New York on one of the most crowded streets, Sixth Avenue. Several others have occurred. Fortunately no lives were lost, but the danger to life is very great. The authorities in trying to manage the electric wires have gone from the frying pan into the fire. The subways are a dangerous nuisance, and there can be no safety until a thorough system of ventilation is introduced. For illustrations of the construction of the subways see SCIENTIFIC AMERICAN of April 20, 1889.

In this connection it is interesting to consider what eminent authorities in Europe say about the safety of electric lighting and the modes they regard as the best. Being three thousand miles away, they are probably disinterested, whereas in this country the electric lighting business is chiefly in the hands of the high pressure companies, who claim their plans are perfectly safe, or can be made safe, and yet they are all the time killing people.

Mr. Werner Siemens, of Berlin, who is probably one of the most practically experienced and scientific electricians now living, in a recent interview with a correspondent of the New York *World*, expressed himself as follows:

"By well constructed underground conduits the danger of electric light wires can be totally abolished if low pressure currents are used, and the dangers resulting from very high pressure can be reduced to a minimum in the same manner. There is no doubt at all that the greatest proportion of such accidents as have happened in New York will cease on the day when the last overhead wire is buried.

"Gas and water pipes," Herr Siemens continued, "can never act as conductors of dangerous electric currents from the underground wires into dwelling-houses. These pipes, if crossed by such a current, would at once divert it into the ground. It is just so with lightning rods, which electricians frequently connect with the water pipes because they make the easiest and most perfect distributers of electricity, diffusing the current over so wide an area as to make it harmless.

"The insulated wires for street lamps should be placed inside of hollow lampposts. For interior lighting (houses, stores, etc.) no high pressure currents should be used unless the construction is such that every possible danger from contact with conductors and lamps is obviated.

"Electric light conductors will never cause fire unless they are carelessly constructed. A well-planned and properly constructed conductor, supplied with the necessary safeguards, is entirely harmless.

"No death caused by contact with electric wires has ever happened here in Berlin. A few accidents by fire have happened in isolated plants, but always because of faulty construction.

"Overhead wires should never have more than 500 volts pressure. Underground conductors, with transformers, no more than 2,000 volts. The transformers and conductors should, however, be tested up to 5,000 volts.

"My system of insulated conductors, protected by lead cover, asphaltum, and sheet iron, has proved successful wherever it has been used—in Berlin, Munich, Rome, Milan, and other Continental cities. Some of these cables have been in use (partly for high pressure and transformers) for six years, and are apparently good for a long time to come. Their exact duration cannot be fixed. Time only can solve that question.

"This system, or a similar one, will overcome all the difficulties you Americans have to contend with. In conclusion, I will say that high pressure should never be used, except where, for pecuniary or technical reasons, it is impossible to introduce low pressure."

The *World* correspondent then called on Herr Emil Rathenau, who is president of the Berliner Electricitats Werke, which supplies the Berlin public with electric lights. He had been kept thoroughly posted by a correspondent in New York of what had been going on in America, and was quite willing to discuss it.

"I have read," he said, "of the numerous accidents in New York, and, in my opinion, your mayor did an excellent thing when he ordered the electric wires overhead to be cut. They should all be placed underground. There is no danger of the currents being carried into the house by gas or water pipes, and thus making mischief. It is absurd. I think the trouble has been caused by the carelessness of the companies. They were probably trying to make money too quickly.

"There are two kinds of accidents which may be caused by electric light wires. The danger to life is one. That we entirely obviate by using only low pressure, no higher than 300 volts, with which we secure an excellent, clear, bright, and steady light. Never a complaint is heard. We have 80,000 lamps in operation now here in Berlin, and we expect to have 160,000 within a year. You see we attain excellent results with this low pressure. We use the Edison lamps, but all the arc lights in Berlin are also fed by our cables. Formerly we used 400 volts for the arc lights, but we find that 300 volts would work as well. A current of that strength is perfectly harmless. You would scarcely feel it. There is absolutely no danger to life. We have 1,500 men in our employ, who all have more or less to do with the wires, but no one in our employ has ever been killed or even injured.

"It is otherwise, however, with the second class of accidents—fires. Low pressure alone will not prevent that danger. But proper construction will. For five years we allowed no one but our own men to put in the plants. With proper care and safeguards there is no danger. Now we allow other contractors to arrange the individual plants, but they must work according to our rules (here Herr Rathenau produced a formidable set of rules, regulating every detail of laying and arranging the wires, insulation, safeguards, etc.) After the work is done it is inspected by one of our experts, and only accepted if properly done. Besides all this precaution, we have everywhere automatic cutoffs, which at once disconnect the current should any wire become overheated. We allow no single wire to carry more than a fixed pressure. We are responsible for all accidents, but we have none. You Americans are the best mechanics in the world, and if you set to work in earnest to perfect your electric light system, no more accidents will happen. It would be folly to discard electric light merely because you have handled it carelessly and burned your fingers.

"We charge for each new lamp (connections and all) placed in a building, 20 marks ($5); such a lamp will last forever. Then we charge 5 marks ($1.25) per lamp a year for keeping it in order, and 4 pfennig (1 cent) an hour of actual use for each lamp of sixteen candle power. At these rates we paid a dividend of 8 per cent this year, besides adding greatly to our reserve fund. Commencing January we reduced the rate per hour to 3·60 pfennig (9-10 of a cent) and still expect to make money. Surely your New York companies can do better than that, for we have a strong competitor in the gas works, which sell 1,000 cubic feet for 5 marks, a much lower rate than obtains in New York.

"Our rates for street lighting are somewhat higher. The city pays us 100,000 marks ($25,000) for the 108 lamps in Unter den Linden and 36,000 marks ($9,000) for the thirty-six lamps in the Leipziger strasse. But then these are lights of intense power, and we had to erect the lampposts, make connections, and take care of the entire plant. The lights burn every night in the year, moonlight nights not excepted."

It will be seen by the facts given in the above interviews that electric light can be furnished cheaply and without exposing the public or the workmen employed on the wires to any danger. It can only be done by using a lower pressure. It rests with the New York companies to take the proper steps, or, if they should prove obstinate, it remains for the authorities, backed by the people, to bring them to a sense of their duty. Her Rathenau also said, in the course of conversation, that his company owns and runs the electric works of Madrid, Antwerp, Eisenach, and other cities, and that their experience there was the same as in Berlin—no accidents and no trouble.

The Muscle Shoals Canal.

The obstructions known as the Muscle Shoals, in the Tennessee River, which covered about 23 miles out of the 453 between Chattanooga and Paducah, at its mouth, are at length overcome by means of locks and dams built by the general government, and the river is now open so that boats loaded at New Orleans can at all times proceed to Chattanooga, and most of the time to Knoxville. The distance from Chattanooga to New Orleans is 1,601 miles, as against 2,067 from Pittsburg and 1,567 from Cincinnati, and it is claimed the coal freights from Chattanooga to New Orleans will be between 80 and 90 cents, as against $1.05 from Pittsburg. The improvement of this short piece of the river has been more or less under construction for sixty years.

Copper Sulphate for Potatoes.

A. W. Pearson, of Vineland, N. J., writes as follows to *Garden and Forest:* For many years in this region of southern New Jersey every attempt to grow the peachblow potato has been a failure. At about the time the plant is in blossom and the tubers are say one-fourth grown, a deadly blight invades the potato field and sweeps over it like fire. I have had an acre of peachblows showing every sign of thriftiness and giving promise of a heavy crop, and in one week from the time of the appearance of this blight every plant was dead or dying. It is the prevailing opinion here that the peachblow potato is a variety which is "run out," and its culture has been generally abandoned.

Happening to see, last autumn, a few bushels of small peachblow potatoes for sale, I bought them for the purpose of giving them another fair trial under the protection of the Bordeaux mixture. Last June I plowed a clover sod between the tree rows of an orchard, and there planted these potatoes in five equal plats of three rows each, manured in the row with the Mapes potato manure at the rate of half a ton per acre. The plats lay side by side, running north and south. When the plants were a foot high, and before they blossomed, I began to spray some of them with the Bordeaux mixture, and repeated this operation every two or three weeks thereafter until nearly the last of September. The times of treatment were regulated somewhat by the weather and the frequency of heavy rains. At any rate, I aimed to keep leaves and stalks on the sprayed plats pretty thoroughly whitewashed with the copper sulphate solution, so that its presence was always visible all over the plants. Whenever a drenching rain washed off the application it was renewed as soon as possible. I made the treatments with the portable Eureka spraying machine. I thus sprayed plats 1 and 2, left plat 3 (the middle plat) untreated, and sprayed also plats 4 and 5.

About the time the plants blossomed, the middle plat (No. 3) was, as usual, struck by the blight, and in two weeks all of the potato tops on this plat were dead and dry. The plants on the other plats were green and growing as vigorously as could be wished. They remained green and growing until killed by frost in November.

I then dug and weighed separately the total product of each plat. Plat No. 1, sprayed with Bordeaux mixture, yielded 346 pounds of fine, large, marketable potatoes, which were sold as soon as dug for a dollar a bushel. Plat No. 3, not sprayed, yielded only 164 pounds of small-sized tubers, scarcely one of which was marketable.

The diameter of the largest tuber on the untreated plat was three inches. The diameter of the largest on the treated plat was five inches. There is a marked difference in the cooking of potatoes from the unsprayed and from the sprayed plats. Those from the plat not treated are immature and "soggy." Those from the treated plats are mealy and have all the excellence for which the peachblow potato was formerly esteemed.

I have saved ten or fifteen bushels of these peachblows to plant next year, in the confident expectation of a crop of 350 bushels of potatoes per acre. Under the unfavorable conditions in which these experimental plats of potatoes were grown (between rows of trees twenty feet apart and twenty years old), I did not expect a large crop. Yet the yield of the treated plat (No. 1), 346 pounds from 225 hills, is not bad, under the circumstances, being about 125 bushels per acre.

Of the Bordeaux mixture employed, the formula is: Six pounds of pulverized sulphate of copper (blue vitriol), dissolved in four gallons of hot water; four pounds of fresh lime, dissolved in four gallons of cold water; mix the two solutions, and dilute with cold water to make twenty-two gallons of liquid.

I believe, however, that the ammoniacal solution of carbonate of copper will be found as efficient a fungicide as the Bordeaux mixture, and it has the advantage of being more readily prepared and more easily distributed in spray. Its formula is: Carbonate of copper, three ounces; ammonia, one quart; mix. The copper carbonate will dissolve almost at once in the ammonia liquor. Then dilute this mixture with cold water to make twenty-two gallons of liquid.

Six New Atlantic Steamers.

There are now six fast steamers building which will press the City of Paris, of the Inman line, very hard in keeping her position as the champion racer of the ocean. The Hamburg American line, whose twin propeller, the Columbia, made a new record of 6 days 18 hours 10 minutes to Southampton on November 14, will have a magnificent new twin screw ship running in May next. She is to be called the Normania, and is now building at the yard of Messrs. John Elder & Co., the constructors of the Etruria and Umbria. The Normania is a little smaller than the City of Paris, being 520 feet long, with 59 feet beam, and 38 feet depth of hold. She will have 16,000 indicated horse power. She will be launched in March next. The keel of her sister ship is being laid by the Vulcan Shipbuilding Company, Stettin. This vessel will not be ready to run until the spring of 1892. She will be called the Venetia. The French line also has a big twin screw ship on the stocks, which will probably be running next summer. She is called the Touraine, and is to be several thousand tons larger than any of the fine single screw ships of the French line, which hold the record between New York and Havre. The White Star steamship Majestic, a sister ship to the Teutonic, will be ready to do battle with the City of Paris next spring. The Cunard line will also put two twin screw boats in the field to win back the lost laurels of the Etruria. Their names have not been selected. They will be powerful ships, and will take the place of the Servia and the Aurania, which will do duty between Liverpool and Boston.

Harvard College Astronomical Observatory.

The annual report of the director, Prof. Edward C. Pickering, presents much interesting information.

A gift of $50,000 was received last summer from Miss C. W. Bruce, of New York, for the construction of a photographic telescope of novel form, which, if successful, will materially affect the entire plan of work of this observatory.

For the last six years experiments have been in progress on the use of a photographic doublet in the preparation of maps of the stars. The eight inch telescope now in Peru is of this form, and was mounted here in 1885. Since then 4,500 photographs have been taken with it. With an exposure of an hour twice as many stars can be photographed as are visible with a telescope having an aperture of fifteen inches, and as many stars as can be photographed in the same time with a telescope of the usual form having an aperture of thirteen inches. Moreover, with a doublet a portion of the sky covering twenty-five square degrees can be photographed with good definition, while only three or four degrees can be covered equally well with telescopes of the usual form. The time required to photograph the entire sky will be reduced in the same proportion. With a doublet each hemisphere could be covered in one year with eight hundred plates. In 1885 it was proposed to photograph the entire sky with the eight inch telescope, enlarging the plates three times. The results would resemble in scale and size the charts of Peters and Chacornac. The generous aid of Miss Bruce mentioned above will permit this result to be attained in the original photographs, without enlargement. A contract has been made with Messrs. Alvan Clark & Sons for a telescope having an aperture of twenty-four inches and a focal length of eleven feet.

The first research on the spectrum of over ten thousand of the brighter stars is now nearly completed and is partially in print. The photographs required for the second research on the spectrum of the fainter stars are also nearly complete. The eleven inch telescope has been in constant use throughout nearly every clear night in photographing the spectrum of the brighter stars. This work is approaching completion for all stars bright enough to be photographed by means of present appliances, with the large dispersion now employed. By the use of an improved process for staining plates with erythrosin, the yellow and green portions of the spectrum, even of the fainter stars, can be advantageously studied. Numerous experiments have been made with a device for measuring the approach and recession of stars, by means of an achromatic prism in front of the object glass. Several peculiar spectra have been studied, especially that of ζ Ursae Majoris. The periodic doubling of its lines seems to be due to the rotation of two components too close to be distinguished by direct observation. The detection of bright lines in one of the stars in the Pleiades suggests a possible explanation of the legend that seven stars were formerly visible in this group.

During last spring an expedition was sent to Peru in charge of Mr. S. I. Bailey, assisted by Mr. M. H. Bailey A station was selected on a mountain about six thousand feet high and about eight miles from Chosica. All supplies for the station, including water, must be carried by mules for this distance. Two frame buildings covered with paper have been erected, one for an observatory, the other for a dwelling house. Since May 9 the Bache telescope has been kept at work during the whole of every clear night; 1,236 photographs have been obtained. A large number of interesting objects have been detected, among others several stars having bright lines in their spectra. Including the photometric work described below, the amount of material so far collected is unexpectedly large.

An expedition under the direction of Prof. William H. Pickering was sent in November, 1888, to the summit of Wilson's Peak, in the vicinity of Los Angeles. In order that as much useful work as possible might be accomplished, the thirteen inch telescope and the eight inch telescope now in Peru were sent to Willows, California, where the total solar eclipse of January 1, 1889, was successfully observed. Forty-seven photographs were obtained by the party during the three minutes of totality, and the instrumental equipment was much superior to any previously used for such a purpose. It was not until May 11 that the large telescope was successfully mounted on Wilson's Peak, by Messrs. E. S. King and Robert Black, but since then it has been kept at work throughout every clear night. The number of photographs obtained is 1,155. The objects photographed are selected from a list of 625 double stars, 143 clusters, and other celestial bodies, such as the moon and planets. As these same objects have been repeatedly photographed at Cambridge with the same instrument, an accurate comparison of the atmospheric conditions of the two places may be made. It will of course be impossible to derive a final conclusion until the observations have extended over at least a year, but the evidence already secured shows that in summer results can be obtained at Wilson's Peak which cannot be obtained here. The difference is very pronounced for such objects as the markings on Jupiter. Clusters like that in Hercules are well resolved, so that the individual stars are easily measured, which cannot be done with the best Cambridge photographs. As a test object the sixth star in the trapezium of the Orion nebula is clearly photographed for the first time. A new variable star has been discovered in the midst of the cluster G. C. 3636. A beginning has been made of the measurements of the position and brightness of the double stars, and it is hoped to extend this work to the clusters, and thus furnish an extensive addition to this department of micrometric astronomy.

PHOTOGRAPHIC NOTES.

A Platina Toning Solution for Silver Prints.—M. Gastine recommends the following:

A.

Water	9¼ oz.
Sodium chloride	300 grains.
" bitartarate	150 grains.

B.

Water	3½ oz.
Bichloride of platine	150 grains.

Add 2 drachms of B to A and tone. "It is advisable," said the author, "to eliminate the silver salts from the paper by one or two washings before toning. If bitartarate is not at hand, take five parts of tartaric acid and mix with four and a half parts of carbonate of soda."

Gelatinous Bottle Wax for Covering Corks.—In storing volatile liquids which are solvents of resinous material, the ordinary bottle wax in which bottle necks are ordinarily dipped is generally inadmissible, by reason of the solvent action of the liquids upon it. In such cases the following answers admirably, giving a perfect closing; and, moreover, the top is easily pared off with a knife when the bottle is to be opened.

Soft gelatine or good glue	3 parts.
Water	9 "
Glycerine	2 "

Melt the gelatine in the water, and then stir in the glycerine. Any coloring matter can be added, and the necks should be quite free from grease when dipped. A second dip can be given if the first does not give a sufficient thickness. Manufacturers sending out photographic preparations containing volatile liquids should give this preparation a trial. The top can be stamped while soft with a slightly greased metal seal, or, when set, a warm stereotype (slightly oiled) or an India rubber stamp may be used.

Mr. J. H. Biggs' Method of Making Silver Prints on Rough Drawing Paper.

Salting Solution.

Soft sheet gelatine	4 grains. (about 0·259 gramme)
Sodium chloride (common salt)	5 grains. (about 0·324 gramme)
Water	1 ounce. (about 28 cubic cents.)

Soak the gelatine and dissolve in a water bath. Whatman's drawing paper is floated on this and allowed to dry spontaneously.

Sensitizing Solution.

Nitrate of silver	60 grains. (about 3·88 grammes)
Water	1 ounce. (about 28 cubic cents.)

Ammonia is added, drop by drop, till the precipitate formed is just redissolved.

Lay the paper on a flat board, the salted side up, and apply the sensitizing solution freely with a Buckle's brush. Pin the paper up by one corner, attaching a fragment of blotting paper to the opposite corner, to prevent the accumulation of solution. When dry, print, tone, and fix as in the case of a print on albumenized paper. Mr. Biggs recommends a carbonate of soda toning bath. For description of the Buckle brush, see next paragraph.

The Buckle's Brush.—This useful implement was quite common and well known in the early days of photography, when negative paper processes were much used, and is very useful when it is important to have a clean brush, or rather mop, for every operation. It is made by taking a piece of glass tube, about half an inch in diameter and six or seven inches long, and drawing a tuft of cotton wool partly into one end of it by a thread or a hook of silver wire, an arrangement easily extemporized.—*Photographic Review.*

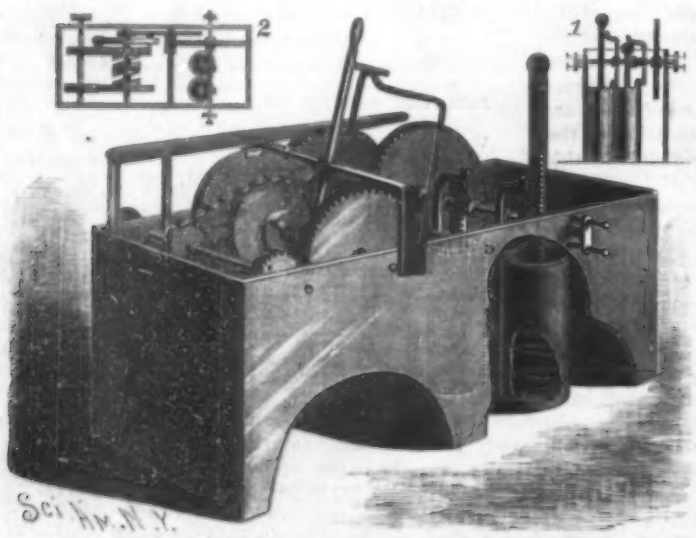
AN IMPROVED COMPOUND ENGINE.

An engine especially designed for use for marine purposes with twin propellers, both shafts thereof being operated by one engine, and also doing away with the ordinary guideways, lessening the cost of construction and diminishing friction, is shown in the accompanying illustration, and has been patented by Mr. James A. Clarke, of Port Moody, British Columbia, Canada. The high and low pressure cylinders are placed vertically one above the other, the exhaust pipe from the high pressure cylinder leading to the steam chest of the low pressure cylinder, while the piston in the upper cylinder is secured on a piston rod extending downward and connected with a piston operating in the lower cylinder, the exhaust pipe from the latter leading to the outside. On the piston rod common to both cylinders is secured a crosshead pivotally connected by two pitmen with opposite crank arms on crank shafts mounted to turn in suitable bearings on the base, which also supports a frame carrying the low pressure cylinder, on top of which is a frame supporting the high pressure cylinder. The valves in the two steam chests are connected with each other by a valve rod connected at its lower end in the usual manner with the reversing link, operated from eccentrics secured on one of the crank shafts. The crank arms stand at angles to each other, so that the crank shafts are turned in opposite directions, and the position of the link is such that it can be readily changed by the reversing lever to simultaneously reverse the motion of the crank shafts. On the crank shafts are also formed two other crank arms pivotally connected by opposite pitmen with a slide mounted in vertical guideways, supported on a frame erected on the base, the motion of the crank shafts causing the vertical sliding motion of the slide traveling loosely in the guideways, and thus serving as a governor, as, in case one of the propellers becomes disabled, the power of the shaft carrying the disabled propeller is directly transferred to the other shaft through the crank arms, pitmen, and slide, and the other propeller is caused to do all the work. In a heavy rolling sea, also, when one of the propellers frequently rises partially out of the water, this means of transferring the power from one shaft to the other prevents the flying around of one propeller and assists the other. All the parts of this engine are within easy reach of the engineer, and there are so few working parts in motion that it is designed to reduce the friction to a minimum, the power of the engine going direct to the cranks. This form of governor can also be attached to any twin propellers without altering the existing engines.

THE CLARKE ENGINE.

A BRAKE AND STARTER FOR VEHICLES.

The accompanying illustration represents a mechanism, patented by Mr. John H. Boom, for storing power during the descent of a vehicle on a down grade, the power to be utilized in propelling the vehicle upon a level or an up grade. Fig. 1 is a vertical transverse section, and Fig. 2 a plan view. A shaft geared to the vehicle axle carries a sprocket wheel and a spur wheel, while a second shaft supports a sprocket wheel and a gear wheel arranged to engage the wheels of the first shaft, a clutch being mounted upon the second shaft between the sprocket wheel and gear wheel and arranged to turn with the shaft and engage either of the wheels. A spring mechanism is connected by gearing with the second shaft and a clutch lever and brake for controlling the movements of the mechanism. The spring mechanism consists of a shaft on which are mounted two pinions, below which are arranged two cylinders containing springs, to the upper ends of which are secured rack bars adapted to engage the pinions, the latter, in the regular operation of the device, first engaging one rack bar to compress one spring, and then the other rack bar to compress the other spring, the rack bars being held to retain the springs under compression until it is desired to utilize the power thus stored. The clutch upon the second shaft can then be moved to use the power, first of one spring cylinder and then the other, through the spur wheels and gearing, there being also a flywheel in the mechanism. The change from one spring cylinder to the other, both in compressing the springs and in using the power thus accumulated as required, is automatically made, while the flywheel relieves the mechanism of the shock of stopping and starting.



BOOM'S BRAKE AND STARTER FOR VEHICLES.

For further information relative to this invention address Messrs. Boom & Loevinger, White Lake, South Dakota.

A Wonderful Astronomical Photograph.

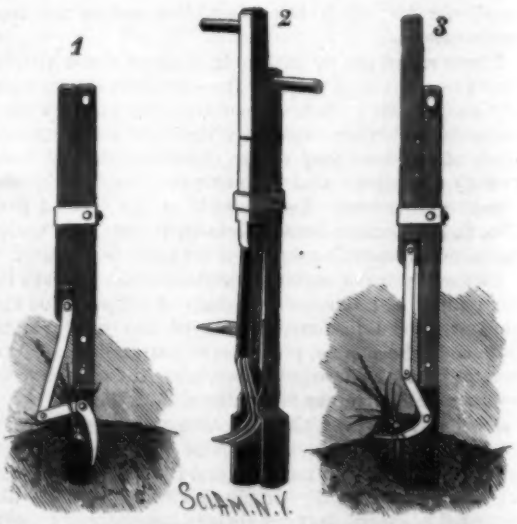
At a recent meeting of the Astronomical Society of the Pacific, at the hall of the Academy of Sciences, corner of Dupont and California Streets, San Francisco, the principal paper of the evening was read by E. E. Barnard, Lick Observatory, on some photographs of the Milky Way and other celestial objects that he had made with a large portrait lens of six inches aperture and thirty-one inches focus, strapped to the tube of the six and one-half inch equatorial of the Lick Observatory, the clock work of the instrument being controlled by hand, with the slow motion rods at the eye end. A star was kept bisected by the cross wires in a high power eye piece on the telescope itself. The additional weight of the camera made it necessary constantly to correct the clock throughout the exposures. With this instrument a negative of the Pleiades was made August 23, last year, with an exposure of 1 h. 15 m. This showed the Merope nebula conspicuously, the sharp prong of nebulosity from Electra, and some of the nebulosity about Maia and Alcyone. A negative of the Milky Way (right ascension 17 h. 57 m., declination south 18·9°), was made July 28, with an exposure of 2 h. 35 m., another in the region about M 11 on August 2, with exposure 2 h. 45 m., and another of the Milky Way (right ascension 17 h. 56 m., declination south 28°), August 1, with an exposure of 3 h. 7 m., and a negative of the great nebula of Andromeda, August 26, with 4 h. 18 m. exposure. The paper was illustrated by lantern slides from these plates projected on a large screen by the aid of oxy-hydrogen light. The nebulosity of the Pleiades was very conspicuous, and the beautiful cloud forms of the Milky Way, with the myriads of stars that they were partly resolved into, were strikingly fine. The slide of the great nebula of Andromeda, when first projected on the screen, had a mask over it, with a small hole, representing (to scale) the largest field of the great telescope on Mount Hamilton. This was moved about over the slide, showing successive fields of view, upon and around the great nebula, indicating what could be seen at once in the great telescope. The mask was then suddenly removed, and the entire nebula, suspended amid countless stars, flashed into view. The contrast between the limited space representing the field of the great telescope and the sky as shown by the photographic lens was astonishing in the extreme. This slide shows the great rings of nebulosity that were first proved to exist by Mr. Roberts, of England. By carefully counting areas, Mr. Barnard estimated that on the original plate (8×10 inches) there were distinctly visible no less than sixty-four thousand stars. This entire plate had been reduced to a lantern slide which, upon the screen, brought out peculiarities in the arrangements of the stars that were not even suspected in the original plate. On all these plates the star images were perfectly round.

On Determining Acoustic Qualities.

Why is it that our men of science, with all their marvelous achievements in various fields, says the *Real Estate Record and Guide*, have never yet discovered the secret of determining in advance whether the acoustic properties of any building intended to hold large audiences will or will not be good? A recent writer, referring to this matter, says that "we have never discovered the principles applicable to the proportions of a great hall by which the voice is spread and conveyed evenly and in the most perfect manner to all parts. After the building is completed it is, confessedly and notoriously, a matter of accident, and a question to be solved by experiment, whether it is 'good for sound.' Furthermore, when the acoustic quality is not satisfactory, it is often not easy to explain why or to devise means to correct it. Here is a field for discovery that has not yet been worked out, nor do we see any rational attempts to solve the problem. Can it be that it is insoluble? Or is it that the properties of sound are still only imperfectly understood?"

AN IMPROVED CORN TRIMMER.

An inexpensive device whereby corn, beans, peas, etc., planted in hills or rows, may be rapidly thinned by removing the surplus stalks, without injury to those left, is shown in the accompanying engraving, and has been patented by Messrs. Dudley B. Robertson and James T. Holland, of Perryville, Ky. Figs. 1 and 3 show the device in different positions in use, Fig. 2 being another view, in perspective. Two standards, having handles on their upper ends, are adapted to slide, one upon the other, and at the lower end of one standard are guard plates, offset to afford clearance for a thinning fork, the lower ends of the guard plates having cutting edges, to facilitate their ready insertion into the soil. Between the guard plates is pivoted a thinning fork, its tines being spaced and attached to a head block, links pivotally connecting the outer end of the head block with the lower end of the sliding standard. There is a foot rest at the side of one of the guard plates to aid in the insertion of the thinner by bearing the foot thereon, when the parts are in the position shown in Fig. 1; the handle on the other standard is then drawn up, rocking the fork as the tines are elevated, as shown in Fig. 3.



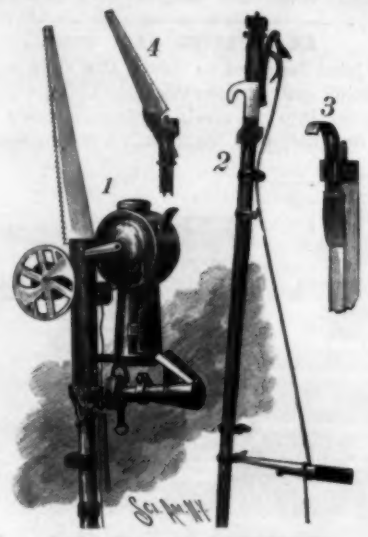
ROBERTSON & HOLLAND'S CORN TRIMMER.

For further information relative to this invention address Mr. James T. Holland, Perryville, Ky.

AN agreement without consideration is void; a note made on Sunday is void; contracts made on Sunday cannot be enforced.

AN IMPROVED PRUNING IMPLEMENT.

An implement adapted for pruning trees irrespective of their height, and for dressing the wounds caused by pruning or trimming, so that danger of bleeding is avoided, is illustrated herewith, and has been patented by Mr. Andreas Bosch, of Prairie du Chien, Wis. The invention covers improvements in the construction of



BOSCH'S PRUNING IMPLEMENT.

an implement formerly patented by the same inventor. In Fig. 1 the implement is shown with the saw in position to saw downward from the upper side of the limb, and with the waxing and shearing and planing attachments in position, Fig. 4 showing further how the saw can be set in an angular position. Fig. 2 shows the device without the saw and waxer and with a different shearing attachment, for trimming away small limbs, to facilitate the operation of which there is a hand cord, while Fig. 3 shows a combined chisel and scraper, for use when it is desired to scrape the tree, and clear away the loose bark and insect nests. The pole to which the attachments are secured is sectional, a short metallic tube with split ends receiving the ends of the pole sections, there being bands around each end of the tube, and set screws for fastening them, whereby the pole may be lengthened as desired. The attachment for planing off the stumps of limbs severed by the saw consists of a blade-carrying disk mounted on a drum within which there is a coiled spring, a strap or cord extending downward from the drum, by means of which the disk may be rotated. The wax can is pivotally mounted, a lamp being placed beneath it for warming the wax, the can being tilted to pour wax on the brush for application as desired by means of a downwardly extending cord. The brush is so supported that a rotary reciprocating motion may be imparted to it.

The Bleaching of Horses.

A curious statement comes from Arkansas concerning a gang of horse thieves, who had for their chief assistant a young woman—a bleached blonde—with the nickname of Sorrel Sue. She was given this name because she always appeared in public riding a sorrel horse. Her excellent horsewomanship and her dashing manner brought her many admirers. The shooting affair which forces her into notice was an ordinary case of plain jealousy. Two of her admirers, both members of the gang, fought for her favor. One was killed, and the survivor was severely wounded. A surgeon was sent for. He mistook the direction and walked into the cabin occupied by "Sorrel Sue." Before he could be hustled out, he saw certain things which aroused his suspicions. These he reported to the sheriff, who with a posse managed to surround the den of the horse thieves, capturing Sue and two of her gang. The sheriff, though pleased with the capture, was more than elated at the discovery of the peculiar method of disguising the stolen animals adopted by the gang. He found that Sue had applied the means of bleaching her own hair to that of the horses.

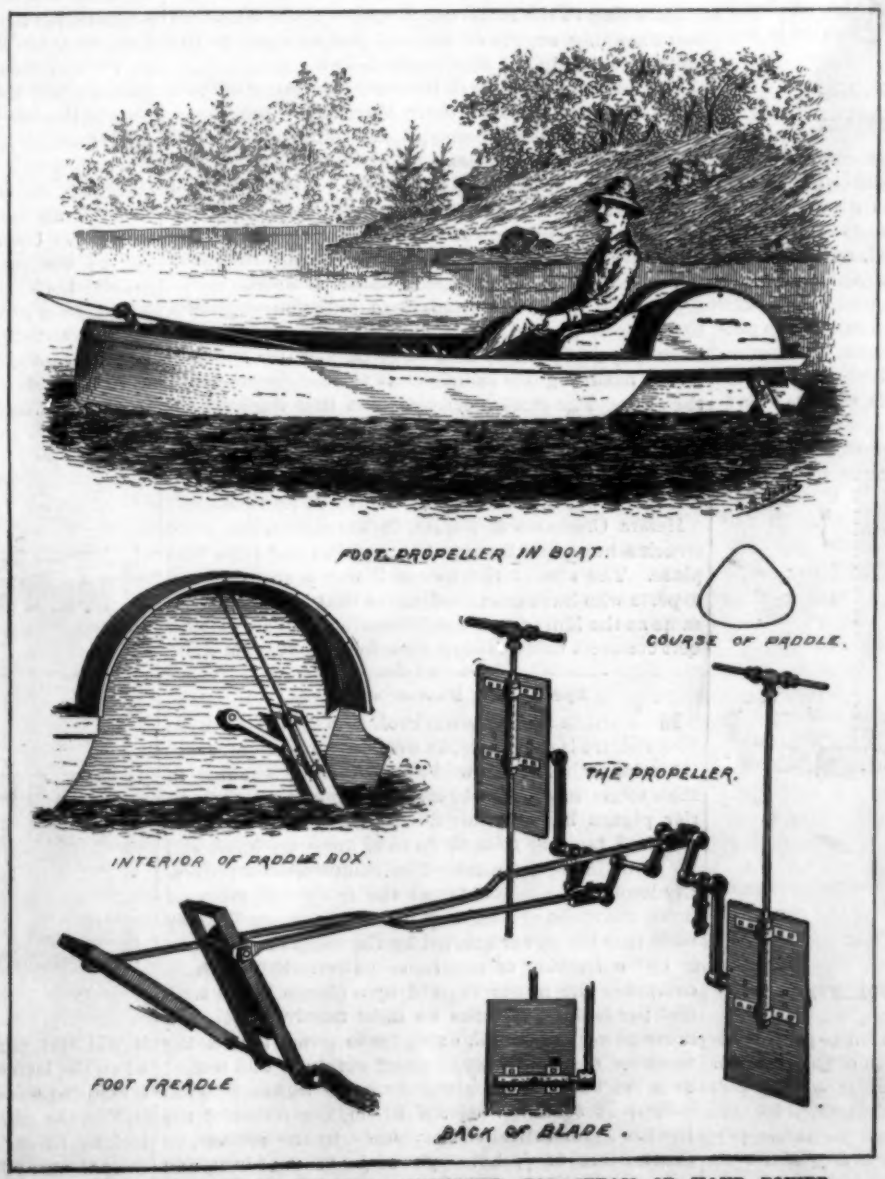
When the posse entered, they found a horse enveloped in a jacket made out of rubber coats, being treated to a sulphur vapor bath. The appliances were very ingenious, and worked very well. A black or bay horse would be stolen and run into the bleachery. After its color was changed and its tail and mane trimmed, the disguise became so pronounced that without any great risk the animal could be taken in daylight through the very district from which it had been stolen. It was Sue's business not only to superintend the bleaching, but also to ride the animal out of the country.

Hydrogen Peroxide.

It has been known for a considerable time that when zinc amalgam and water were shaken with air, hydrogen peroxide was found in the solution in small quantities. The greater part formed was however employed in oxidizing the zinc. It has been found that if some substance be present which is capable of combining with the hydrogen peroxide as it is formed, the yield is greatly increased. A patent has recently been granted in Germany (D. P. 48,542) for a process founded on these observations. A fluid amalgam, containing not more than 1 part of zinc or cadmium to 1,000 of mercury, is shaken with milk of lime and air. If a little potash is present, the reaction is accelerated. The hydrogen peroxide combines with the lime, forming calcium peroxide, which is precipitated. The mixed precipitate, containing calcium zinc oxide and calcium peroxide, is treated with an acid which will form insoluble salts with the two metals, while the hydrogen peroxide goes into solution.

THE FEATHER BLADE ELLIPTIC PROPELLER.

This is a mechanical movement which applies to the propulsion of vessels. The path of the paddle is an ellipse, whose longest diameter is horizontal, so that the paddle or propeller is carried through a certain arc of greater or less magnitude, according to the dimensions of the parts. The longest movement of the paddle is when it is immersed, and the paddle being vertical, there is no splash, slip, or loss of propulsive effect arising from the oblique action. Greater speed can be obtained than by any other form of propeller, and a greater saving of power. The movement can be placed at the side, stern, or center of vessel. Sportsmen will find it of great value running up narrow streams where the common oar could not be used. The foot movement would be of great use for ladies, especially those unable to use the oar. It is claimed that there is a gain of 25 per cent over any other means of propelling on the water. The movements can be made of wood or steel. The propeller can be run by the hand, foot, or by steam power. Designed by George U. Tibbles, Jersey City, N. J.



THE FEATHER BLADE ELLIPTIC PROPELLER, FOR STEAM OR HAND POWER.

AN IMPROVED BICYCLE BRAKE SHOE.

The soft rubber tire of a bicycle wheel, especially where the rubber is not of the best quality, after a certain amount of use loses its circular form, and, as the brakes heretofore in use have been adapted to take a full hold only when the tire is circular in cross-section, the rider has by no means as full a control of his machine, by means of the brake, when the tire becomes worn. It is to obviate this difficulty that the brake herewith illustrated has been devised and patented by Mr. John J. Astor, Jr., of No. 128 West Twenty-sixth Street, New York City. The brake shoe is made of spring metal, and, as shown in the small view, is slotted longitudinally, so as to cause it to adapt itself to the periphery of the tire without regard to the cross-sectional shape of the latter, and adapt itself with equal advantage to either a new or a worn tire. One or more slots are used as may be required, to enable the brake shoe to fit the tire as perfectly as possible. Its form is such that it can be readily shaped by a drop press or some analogous means, the outer edges of the shoe and

ASTOR'S BICYCLE BRAKE.

the edges of the slits being rounded to prevent the shoe from injuring the rubber tire. The shoe is pivoted to the fork which supports the wheel, and is connected with the brake lever by a rod in the usual way. The several divisions of a shoe thus formed act independently of each other, each division effecting its due proportion of friction, thereby reaching the whole of the tire surface for the frictional bearing upon which the shoe acts.

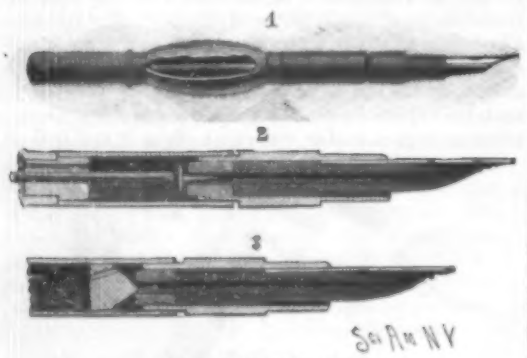
The Buenos Ayres-Montevideo Telephone Line.

The trunk line connecting Buenos Ayres and Montevideo was opened with considerable ceremony on October 26. This line, which is 186 miles long, is worked on the Van Rysselberghe system. The work of construction was intrusted by a private company to M. C. Laborde, and the Felten Guilleaume cables and bronze wires were supplied by Messrs. W. F. Dennis & Co., of Billiter Street. The line is carried on posts along either side of the River Plate from Buenos Ayres and Montevideo respectively to the points where the river is crossed. The connection here is established by means of submarine cables, which cross the river at a breadth of 28 miles. In the vicinity of Montevideo the bronze wire spans a distance of 460 yards across the river Santa Lucia, by means of poles 108 feet in height. The charges for the use of the telephone are worthy of notice. During the busiest part of the day they are as follows: For five minutes' use $5, for five to ten minutes' use $12.50, for ten to fifteen minutes' use $25. The line has so far given satisfaction both as regards articulation and loudness.

RIFLE bullets are now photographed in their course by means of the electric spark. The camera is taken into a dark room, which the bullet is caused to traverse. As it passes the camera it is made to interrupt an electric circuit and produce a spark, which illuminates it for an instant and enables the impression to be taken. The wave of condensation in the air before the bullet and the rarefaction behind it are visible in the photograph, and can be studied by experts, thus enabling the form of ball or rifle which minimizes the resistance of the air to be selected.

AN IMPROVED FOUNTAIN PEN.

A pen in which the pen staff or holder is provided with a compressible air bulb for controlling the supply and flow of the ink is shown in the accompanying illustration, and has been patented by Mr. John D. Bray, of Grand Seminary, Montreal, Canada. Fig. 1 is a full view of the pen and holder, Fig. 2 being a sectional view of its forward portion, and Fig. 3 showing a slightly modified construction. The rear end part of the tubular pen-holding section is fitted to slide closely within the forward end portion of the ink reservoir, and this section has entered in it from its rear a short tube, of soft rubber or other elastic material, projecting slightly beyond the back edge of the pen-

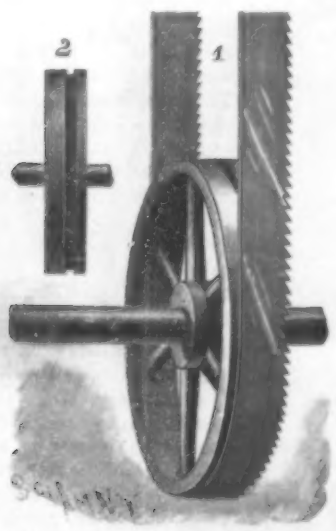


BRAY'S FOUNTAIN PEN.

holding section. The latter is also closely fitted with a section and feeding tube, terminating in front in a curved nose piece, with contracted opening, for supplying the pen with ink. The tube entering the rear end of the pen-holding section forms a valve seat for a stationary valve attached to a rod extending centrally backward. A flexible air bulb is arranged in the rear of the ink reservoir, and connected therewith by a filling piece having an air duct through it. This filling piece and the closing piece at the rear end of the air bulb are connected by the rearward extension of the valve rod. In the whole construction, including the valve and adjustable pen-holding section, close threaded connections and flexible washers are dispensed with. When wishing the flow of ink from the reservoir to the pen is first adjusted by drawing slightly outward the pen-holding section, to open the valve, and afterward by the writer exerting a more or less slight pressure with his thumb and forefinger upon the bulb. After finishing writing, the pen-holding section is moved backward again within the reservoir, to close the valve, and a cap, held on the outer end of the pen-staff, is placed over the forward end of the pen-holding section, when the pen may be safely carried in any position in the pocket.

AN IMPROVED BAND SAW PULLEY.

A pulley for band saws, whereby an equal tension will be obtained upon the front and back edge of the saw when passing over the pulley, thus obviating the necessity of hammering or rolling the saw in the middle to make the tension of both edges equal, as has heretofore been done, forms the subject of an accompanying illustration, Fig. 1 showing the saw in position on such pulley, of which Fig. 2 is a front elevation. It is a patented invention of Mr. Jacob R. Hoffman, of Charleston, West Va. The pulley is provided with a rectangular peripheral groove at one side of its center, where-



HOFFMAN'S BAND SAW PULLEY.

by the teeth of the saw will be permitted to project beyond the pulley. The depth and width of the recess or groove will be varied according to the size of the pulley and the width of the saw. A saw intended for use in connection with this pulley should be made perfectly straight, and the pulley is designed to insure its remaining in this condition until broken or worn out.

"The Northwestern Miller."

One of the most beautiful specimens of the typographic art is the holiday number of our valued cotemporary the *Northwestern Miller*, published at Minneapolis, Minn. The specimen referred to contains 128 pages about the same in size as the SCIENTIFIC AMERICAN. A large number of elegant and original engravings are presented, among them portraits of the officers of the National Millers' Association, enterprising and vigorous looking men, officers of British trade associations, etc. Several plates in colors of prominent milling establishments are given. Some two hundred and fifty letters are printed from millers in all parts of the country, giving their several views upon the condition, prospects and wants of the trade. The general literary contents are excellent. We congratulate the *Miller* upon its success and prosperity, of which this superb issue is a substantial evidence.

Spontaneous Combustion of Cotton.

The Boston Manufacturers' Mutual Fire Insurance Co. warn their customers by special circular of new sources of danger of fire from cotton bales impregnated with cottonseed oil, as follows:

Since the introduction of cottonseed oil and its transmission in casks and barrels from one part of the country to another, a new danger has arisen to cotton in transportation, as cotton fibers saturated with this oil are very liable to spontaneous combustion. It may be that the more frequent fires in large cotton warehouses of the South and in cotton ships can be accounted for in this way. Up to this time the mutual insurance companies have been subjected to but one loss in a cotton storehouse which could be attributed to this cause. This season, however, an instance of saturated cotton bales has been discovered in one of our principal mills. Two bales have been received, one of which was saturated to the extent of 256 lb.; the other to the extent of 175 lb. They were fortunately discovered to be in this condition, and a claim for damages has been made upon the transportation companies. A sample of the cotton has been examined at the Institute of Technology, and tested in our spontaneous combustion oven. It ignited at moderate heat in the way in which fibrous substances ignite when saturated with a drying or quickly oxidizing oil. The oil pressed out from this small sample has been subjected to qualitative tests, which prove it to be cottonseed oil. We therefore warn all our members who represent cotton mills that it would be prudent to have their cotton carefully examined for oil, bale by bale, before putting it into the warehouse.

Natural Gas Items.

According to the Pittsburg *Dispatch* there is still an overwhelming supply of natural gas at some of the wells, however much others have failed.

The *Dispatch* says: Park Brothers were lately obliged to shut down three of their Murrysville gas wells, owing to the pressure being greater than the pipes can carry. This company has a 20 in. diameter main running from the Murrysville gas fields; yet so strong and so plentiful is the gas that they assert they can supply not only their own great works, but also the sixteen other large mills which take gas from them throughout the winter with the decreased number of wells.

The pressure at the Homestead reducing station is 500 pounds to the inch. This gives them more gas than they can possibly use. The outlook for the winter for natural gas is as bright as the consumers want, they say. The same inconveniences that were experienced last year by limited supplies, stoppage of work, and in many cases causing hardship and giving limited supplies of bread, are not likely to transpire this winter, according to present indications

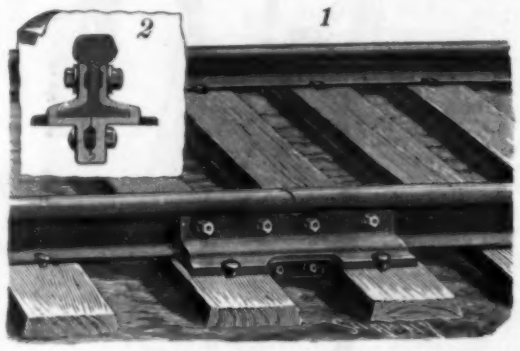
Messrs. Chalmers & Taylor, of Tarentum, Pa., have struck a huge spouter about three miles east from that place. The size of the new well was a surprise, and experts who have examined, agree that the sand is the same as the Murrysville sand, showing plausibly that a belt connects this territory with the Murrysville field.

Speed and Power of Birds.

In an article in the *Forum* Prof. R. H. Thurston says: The vulture is said to fly, at times, at the rate of above 100 miles an hour; the wild goose and the swallow, in their migrations, make 90 miles an hour; and the carrier pigeon has certainly flown long distances at rates of speed ranging from 60 up to 80 miles an hour, and for many hours together. The common crow ordinarily lounges across country at the rate of 25 miles an hour, the speed of a railway train. Professor Langley finds that the power exerted by the eagle in full flight is but a fraction of one horse power. Mr. Chanute computes the power exerted by a pigeon flying 2,200 feet per minute, 25 miles an hour nearly, at $\frac{1}{110}$ of a horse power per pound, or 9½ horse power for a flying machine of equally good form, weighing one ton, at 25 miles an hour, or about 50 horse power per ton weight at 50 miles. Mr. Wenham, a member of the British Aeronautical Society, finds, in the pelican, an expenditure of $\frac{1}{11}$ horse power by 21 lb. of bird, and this is one horse power to 231 lb., or about a horse power for the weight of a man, allowing ample margin for surplus power. The birds are found to have a surplus lifting power of about one-half. Professor Langley has purchased recently for the Smithsonian Institution the prize steam engine of the Aeronautical Society of 1868, which, with car and screws, weighs only 16 lb., and but 13 without these essentials. To the engineer these facts certainly look encouraging.

AN IMPROVED RAIL JOINT.

A rail joint designed to insure the rigid support of the abutting ends of the rails joined, and which can be rolled from iron or steel, to form a joint which is strong, durable, and inexpensive, is illustrated here-

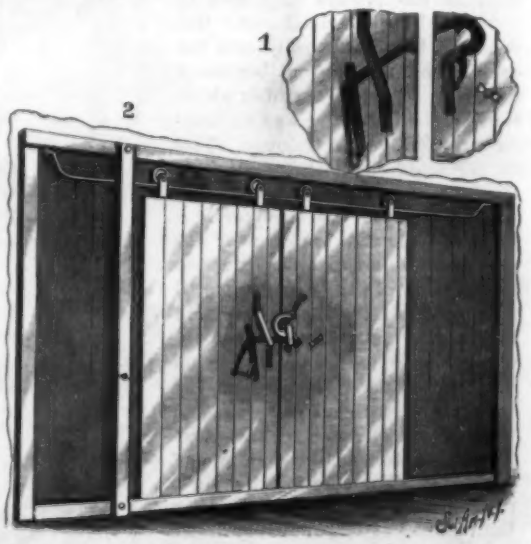


LYND'S RAIL JOINT.

with, and has been patented by Mr. Ives Lynd, of 373 Congress Street, Troy, N. Y. Fig. 1 is a perspective view, showing the joint applied, and Fig. 2 is cross section. The joint is made in two sections, each of which is shaped to receive one-half of the base of a rail, and to fit against the rail web and the under side of the rail tread. These sections each have downwardly extending vertical flanges, below the base of the rail between the ties, the flange of one section having a groove, and that of the other a flange adapted to enter the groove, to hold the parts against vertical displacement. These vertical flanges are preferably formed after the sections have been rolled and cut to proper length, thus giving a broad tie-bearing at each end of either section, with recesses to receive the spikes. A joint thus formed constitutes a bridge and vise, preventing the depression of the end of one rail below that of the other, whereby pounding is avoided and a very strong joint is made.

AN IMPROVED DOOR LOCK.

A lock for stable doors, etc., in which the parts are so arranged that the door will latch upon closing, and the latch will be locked and held against displacement, is illustrated herewith, and has been patened by Mr. John Connor, P. O. box 56, Whitestone, Queens Co., N. Y. Fig. 1 shows the parts as they appear when the door is open, the catch arm pivotally mounted on the door to the left being guided by a strap, and having a catch hook on its outer end, while its inner end is carried downward and connected to a short arm that is rigidly mounted on a key shaft, which extends outward through an escutcheon secured to the outer face of the door. Upon the other door is a keeper adapted to engage the catch hook, and above the keeper is a gravity hook, rigidly connected to a key shaft, an arm with lateral projection holding the gravity hook in the position shown in Fig. 1, and so that the catch hook in entering the keeper will carry the gravity hook forward to lock the door, as shown in Fig. 2. A stop limits the inward movement of the catch hook, so that



CONNOR'S DOOR LOCK.

it will rest practically within the edge of the door when the latter is open, and a button on the other door is adapted to prevent the operation of the gravity hook to lock the doors when it is desired to close without locking them. A key is used for each door, one to raise the gravity locking hook and the other to raise the catch arm to the positions shown in Fig. 1.

THE NEW YORK POST OFFICE.

In the days of its Dutch occupancy, when the city of New York was termed New Amsterdam, there was no post office. Foreign letters were delivered personally by the agents of ships and by the officers, sailors, and passengers. Unclaimed letters were left in the hands of some private citizen until called for. As the volume of the business increased, a system of voluntary distribution from the taverns was developed, and the so-called "coffee house delivery" was maintained for over one hundred years.

When the English obtained possession of the quiet old city they left matters as they were for some years, but in 1686 an official order was issued that ship letters must be delivered at the custom house, and in 1692 a post office was established, the city then having a population of not far from 6,000 inhabitants.

In 1710 a "chief letter office" was established, and arrangements were made for the delivery of the Boston mail twice a month. On May 4, 1732, the post office was removed to Broadway, opposite Beaver Street, according to an advertisement in the New York *Gazette* of May 3, signed by "Richard Nichol, Esq., P. M." In 1753 Dr. Franklin was appointed Postmaster-General. Up to this time the coffee house delivery was still in existence, and was eventually considered an injury to the revenues of the regular service. Alexander Colden was postmaster of New York until the breaking out of the revolution. For the period of the war the records are missing, but in 1785 William Bedlow held the office, and was succeeded in 1786 by Sebastian Bauman. In the first year of his incumbency the income of the office was $2,789.84.

A little over one hundred years ago, during Mr. Bauman's incumbency, the post office department, substantially as at present constituted, was established with seventy-five post offices and 1,875 miles of post roads. Josias Ten Eyck succeeded Mr. Bauman, holding the New York office for the year 1803, and was followed by General Theodorus Bailey, who retained the position for nearly twenty-five years, dying September 4, 1828. He moved the office to No. 29 William Street, corner of Garden Street, now Exchange Place. The next move, in 1825, was to Exchange Place, and two years later it was moved to the Merchants' Exchange on Wall Street, between William and Pearl Streets. In 1835 the building was burned in the great fire, and the post office was moved to the rotunda in the City Hall Park. The next change was in 1845, to the Middle Dutch Church, in Nassau Street, extending from Cedar Street to Liberty Street. Thence it was moved in August, 1875, to the present building, erected for the purpose by the federal government.

The building even now affords insufficient accommodation for the operations of the office. It contains too many columns, which are found to interfere with the work of transportation of heavy matter, etc., and before many years some relief will be necessary. A part of the building is occupied by federal court rooms and offices, which eventually may have to be established elsewhere.

The New York office is now under the management of Mr. Cornelius Van Cott, New York postmaster, and represents the highest grade of efficiency in its many departments. Our thanks are due to him and to Mr. J. Gayler, assistant postmaster, for courtesies received. Mr. Gayler is one of the oldest employes, having been in the service for thirty-five years, representing the best principles of true civil service.

The United States Post Office Department may be considered as executing its work in two general divisions, one the railway post office and the other the stationary post offices. The work of the entire department is executed in large and small post offices throughout the country and in railroad cars, its operations ramifying all over the land. To acquire any conception of its processes it must be remembered that one division assists the other to the utmost of its power, each playing into the other's hands.

We illustrate in the present issue the work of the New York City Post Office. The working divisions of the office are as follows: The executive division, first division, financial accounts; second division, mailing and distribution, third division, city delivery; fourth division, registry; and fifth division, money order. In the city, besides the central office, there are eighteen branch stations tributary to it, besides twenty sub stations at which mail matter is received but not delivered. The branch stations both deliver and collect letters.

Mail matter reaches the New York office through several channels, in some cases with canceled, in other cases with uncanceled stamps. The mail with uncanceled stamps comes to the office in three ways. A part reaches it in bulk from large mailing firms, publication offices, etc. This is delivered on Mail Street, at the north side of the building. Large scales are provided on the platform for weighing it, and it is discharged through chutes, shown in Fig. 8, to the basement. A second source is the letter and package drops in the main corridors of the building, shown in Fig. 6. Another source is lamp-post boxes, whence it is taken by collectors attached to the office.

The first operation the letters have to undergo is termed "facing up;" this means arranging them with their addressed sides all in the same direction and right side up. As fast as the letters fall into the post office drops the clerks in charge thereof perform this work, one of whom thus engaged is shown in Fig. 2. He is a veteran of the war, and has but one arm, yet is found very efficient. As the collectors bring in their collections they also face them up and divide them into two general divisions. One includes letters for city delivery, the other includes out-going domestic and foreign letters. For this work long tables are provided, along one side of which the collectors arrange themselves for facing up and separating their letters, while along the other side are stamping clerks. Both carriers and clerks engaged in these operations are shown in Fig. 3. As fast as the letters are faced up by the carriers they are placed on shelves over the center of the table, within easy reach of the stamping clerk. The letters from the post office drops, already faced up, are handed also to these stamping clerks.

The stamp with which the letters are marked is a double one, containing a canceling device as well as one for post-marking the date and hour. By means of these stamps at one blow two impressions are produced upon the letter, one "killing," as it is called, the stamp, the other giving the time of its deposit. The letters, when being stamped, are placed upon a thick sheet of India rubber. For "killing" the stamps on circulars, newspapers, and packages a special kind of stamp, made of printer's roller composition, without date is used. The time in the letter stamps is changed every half hour by a special clerk who goes the rounds periodically making the change, and, by registering impressions in a book properly divided, keeping a record of changes made. This precaution is taken in order that no possible doubt may exist as to the time at which a letter reaches the post office—and is found particularly useful in cases where negligent messengers have failed to mail promptly letters intrusted to them for that purpose.

The separation of letters received at the New York post office drops is effected, to a certain extent, by the public, who mail them in outgoing domestic, New York City, and foreign countries delivery drops. This corresponds to the first separation made by the collectors.

Letters from other post offices, from branch stations in the city, and from all parts of the world are received with stamps already killed. The date of receipt at New York is stamped upon this class of mail upon the backs. It is termed backstamping.

Upon the main floor in the central office, shown in Fig. 4, are situated a number of tables, from which rise up cases of pigeon holes, each pigeon hole labeled. These are called the separation and distribution tables. Most of these are used for dividing the mail addressed to different parts of the United States and Canada. The first operation is termed separation. There are 75 separation tables, all duplicates of each other, each provided with 90 pigeon holes. The titles of the pigeon holes may be classified in three divisions. The first division includes boxes devoted to a special post office; there are comparatively few. There are ten in the State of New York, three in Pennsylvania, three in Ohio, and so on. The letters placed in these pigeon holes are tied up in bundles and receive no further distribution within the office. The second division includes letters for (a) New York State in general; (b) New Jersey; (c) Pennsylvania; (d) Maine, Massachusetts, Vermont; (e) Connecticut, Rhode Island, New Hampshire, and Canada; (f) Ohio, Indiana, Illinois, Tennessee, Virginia, Texas. All of those mentioned under the second division have to be redistributed in the office. The third division includes remaining States of the Union, and is distributed by the railway post office, after separation on these tables. Five distribution tables receive the second of the divisions designated above from the separation tables. One table is devoted to New York, another to New Jersey, another to Pennsylvania, another to the Eastern States and Canada, and one to the South and Western States, as just specified. Here the letters are still further distributed. Some are placed in boxes, labeled with the names of post offices, to which they go directly. Other boxes are marked with the name of the place followed by the letters "D and D." In these are placed letters intended for direct mailing to that post office, as well as to be distributed therefrom as a local center. A third and very numerous class are marked with the names of railroads, and are distributed from the cars to post office stations on the line of the roads by the railway post office clerks.

On the New York State table 393 of these distributions are made, and on the Pennsylvania and the New England and Canadian tables respectively 224, for New Jersey there are 126, and for the Southwest 73 distributions. Were the clerks simply required to refer the numerous post offices each to the box including it, the feat would be a considerable one, but in addition to this, changes are continually being made, owing to new railroad arrangements, which bring post offices into other boxes, and the clerk has to keep accurate watch of all such changes.

Probably the most complicated department is the New York City distribution. These letters have been separated from the general mail partly by the public mailing them in designated boxes in the post office, partly by the collectors on reaching the office, and the remainder at the 75 separation tables. At the New York City tables pigeon holes are provided open at front and rear. They are arranged and marked to correspond to the carriers' routes supplied from this office and partly to the branch stations. For these the street address is the guide. The distributing clerk must at once refer this address to the proper office in whose district the street is included, or to the carrier's route on which it lies, and throw the letter into its proper box. In some cases the odd and even numbers on a street will fall to different divisions. At the same time the clerk has to watch for all names of holders of lock boxes. These, even if directed to street addresses, go to the box belonging to their receiver. The clerk therefore has to know the name of every box holder in the city, of whom at present there are 3,000.

The mail for foreign countries is distributed on the same general lines by being thrown into proper pigeon holes. In this department there are 14 distribution tables, each having 39 boxes.

The weight of letters passing through the post office is watched. Those that seem too heavy are weighed, in order that unpaid postage may be collected upon them. All such go to the mail inspection and rating department, falling under the first division.

The letters leave the office in pouches after separation and distribution for all districts except the carrier district of the office. They are removed from the pigeon holes, are tied in bundles, and each bundle is labeled with the name of the pigeon hole from which its contents is removed. They have next to be "pouched." For this purpose a large semicircular table is provided with a range of large sized pigeon holes whose floors are inclined downward in the rear. These are marked with the names of railroads, cities, etc. The packages of letters are thrown dexterously into the proper compartments, whose labeling does not correspond necessarily with that upon the packages. At the back of these inclined pigeon holes sacks may be attached by hooks to receive the bundles as fast as thrown in, or the pigeon holes may be closed at the back and their contents removed from time to time. Both systems are employed. The letters go out in these pouches, some to post offices, and some to be opened on the trains and sorted and separated and distributed along the route by the railway post office employes. For city branch offices the pouching is done in simple frames supporting the bags by the mouth as shown in Fig. 7.

To the mailing of newspapers a special department, occupying most of the basement of the building, is devoted. Here the papers and circulars are received in bulk in sacks, which come down inclined chutes from Mail Street, as shown in Fig. 8. The work done here in the separation and distribution compares closely with what is done on the floor above. There are ten separation tables, each with sixty-four divisions or boxes. Five distribution tables are supplied from a limited number of the boxes of the separation tables. There is also one table specially provided for news dealers' packages. The work at a newspaper separation table is illustrated in Fig. 5. As an example of the work done in this department it may be stated that on the New York table there are 576 distributions effected, on the New England table 144 distributions, and for the other three tables from 125 to 150. The third and fourth class matter handled in this department is stamped with a special stamp. Matter sent out from 1 A. M. to 10 A. M. is stamped with a figure 1, from 10 A. M. to 7 P. M. with a figure 2, and from 3 P. M. to 1 A. M. with the figure 3. It is placed on elevators, shown in Fig. 1, and delivered to the mail wagons on Mail Street, north of the building. As the elevator rises and descends it opens and closes automatically a safety door covering the orifice.

In the basement storage for sacks and pouches is provided, as shown in Fig. 9, where they are stored away, labels cut off, and whence they are taken as required. The repairs of sacks and pouches is all executed in Washington.

Forbidden articles fall into two classes—those prohibited by the Postal Union and those by the United States laws. A large quantity of matter is held back as unmailable every year, and the sender notified.

A number of letters with undecipherable or meaningless addresses are received. We give some sample addresses: "Your friend, Claus S. Anderson. P. S. I think I will go to bed. North America." "Shipped Knocked Down. Can be set up by any cabinet maker. New York, Mexico." "A Happy New Year. Thomas Souniel, Cuba." "Mr. Brooklyn President St., New York, United States." The first three represent a very numerous class written from circulars or the endings of letters by those ignorant of the language. If undecipherable they are sent to Washington, and occasionally some are interpreted there.

Some statistics of an approximate year's business will be of interest. Such would include about 216,-

000,000 letters, postal cards, and newspapers delivered by carriers, 350,000,000 collected in the city from all sources, 34,000,000 letters forwarded to foreign countries, and over 25,000,000 received from the same. Over half a million of letters are misdirected annually, and of these about 86 per cent are forwarded to their correct destination. The dead letter office at Washington, D. C., receives about one million pieces of mail matter. In a working day, on the average in round numbers, 620,000 letters, weighing 16,000 pounds, are disposed of, in addition to 10,000 sacks of second, third, and fourth class matter. The whole represents 500,000 pounds. The carriers dispose daily of about 8,000 pounds of letters and postal cards. In the year 1889, 200,000,000 pounds of mail were handled in the office. The registered letter department forwarded during 1889 nearly three millions of dollars as gold coin in bulk.

NEW LETTER STAMPING MACHINE.

The Hey and Dolphin letter stamping machine is now in full operation in the New York post office. It was put there on trial, seven months ago, by authority of the Postmaster-General. The post office officials here are greatly pleased with it, and Postmaster Van Cott has made a very favorable report of its merits to the Washington authorities.

The machine combines the merits of great speed, effective cancellation, uniform and legible postmarking, and an accurate registry of the number of letters and postal cards operated upon. It is claimed that it will cancel, postmark, count and stack the letters and postal cards at the rate of 30,000 per hour. On November 2, it canceled, postmarked, counted, and stacked 187,980 letters in the course of twelve hours, and it has disposed of 3,000 postal cards in 4 minutes and 50 seconds. It has canceled, postmarked, counted, and stacked 24,000 postal cards within an hour. In two hours and two minutes it canceled, postmarked, counted and stacked 46,480 letters and postal cards, of which 21,000 were letters. Of course this record would have reached higher figures but for the idle intervals which occurred to the machine owing to the failure of the supply of letters.

It is this great capacity for speed that gives to the machine its principal value.

The work of canceling and postmarking letters as done by the old fashioned hand stamp is the chief hinderance to a quick and satisfactory postal service in cities. It sometimes happens that letters and postal cards are deposited in the post office in such great quantities just before the closing of the mail that the clerks are unable to cancel and postmark them in time, and consequently a portion of them must necessarily be detained over until a later mail than the one for which they were posted. Fast mail trains and faithful letter carriers are of no avail for letters detained over because insufficient time has been allowed the post office officials to cancel and postmark them.

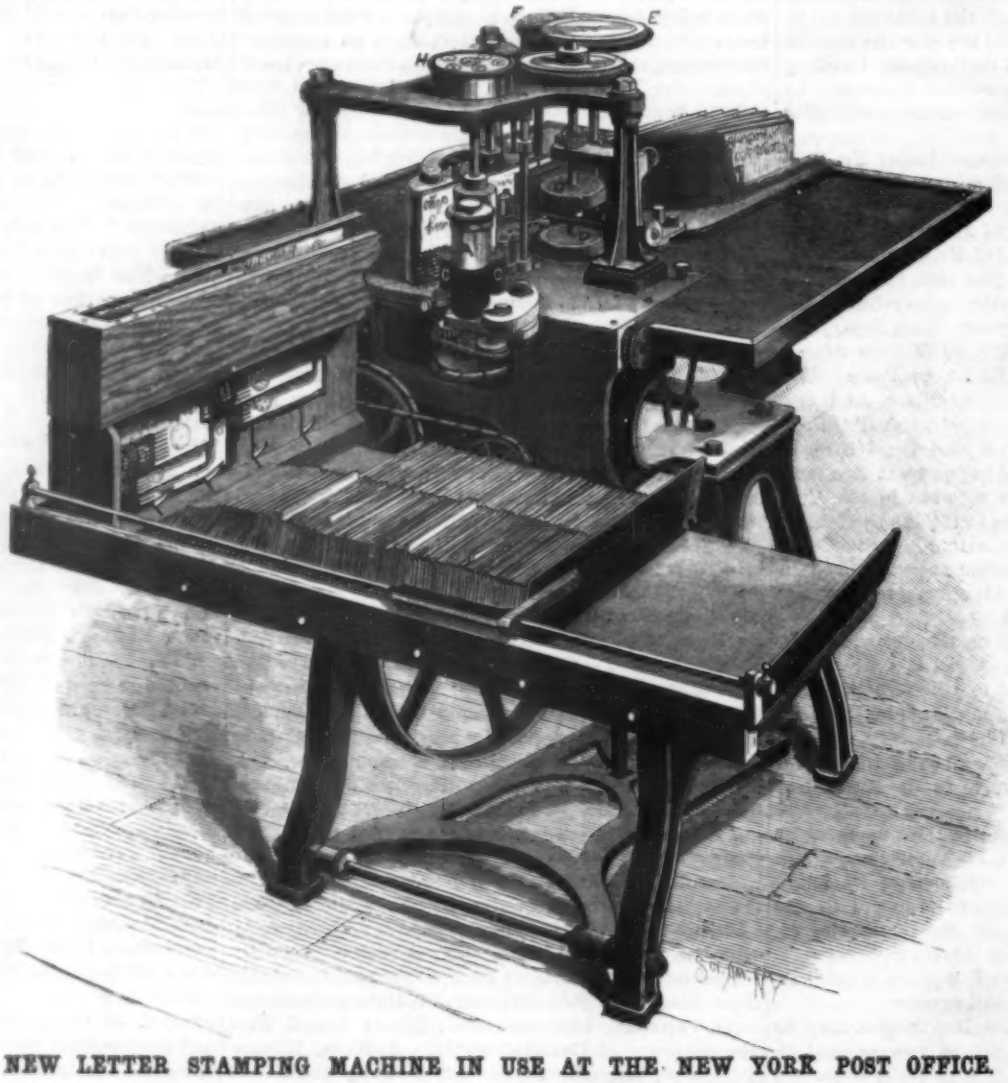
The government has been long in need of machinery having great speed for doing this work, and the importance to the public of its introduction at this time cannot be overestimated. By placing the necessary number of machines in each post office the officials will be given absolute control over the quantity of work to be done in a given time, and no letter need be detained for a later mail than the one for which it was posted.

The machine is compact, and condenses its numerous functions and great capacity within very limited dimensions. It comprises a receptacle or hopper, a combined feed and separator, a counter, a printing device, and a stacker.

The operations are wholly automatic. Letters of indiscriminate sizes are placed in the receptacle, and are immediately carried forward to the feed and separator, which feed the letters forward with great rapidity, while preventing the passage of more than one letter at a time.

The letters are placed upon their edges in a species of horizontal hopper, whose under surface is formed by an endless belt continually tending to draw the letters on. A curved wall deflects them, one a little in advance of the other. They first pass between two feed rolls, carried by vertical spindles, actuated by the driving pulleys, E and F. These pulleys are connected by an endless belt, and one is much larger than the other. This introduces the feature of differential feeding which distinguishes the machine. The roller actuated by the small pulley, F, travels at comparatively high speed in the positive direction, tending to feed the letters forward. The roller actuated by the large pulley, E, rotates in the negative direction, tending to push the envelopes back. The distance apart and pressure exerted by these rollers upon the envelopes between them is adjustable, and all the letters, except one or two, are held back by the differential or negative roller.

In this way the first separation is effected, and two, or at the most three, letters go forward. Another set of differential feeding rolls have next to be passed, which, however, are set much closer to each other. They work on the same principle. The negative rollers are seen at D D, while the driving pulleys with connecting belt are shown upon the top of the frame. These only permit one letter to go through, the rollers,



NEW LETTER STAMPING MACHINE IN USE AT THE NEW YORK POST OFFICE.

D D, holding back any other. Under the action of two positive feed rolls, one of which is shown at B, the letters are fed forward. An ink font, A, and inking rollers, C C, are seen in the front of the machine. Back of these is a feed roller. Working in unison with it, and practically forming a continuation downward of this roller, is a rotating die. The roller, B, acts as a pressure roller, forcing the letter against this rotating die, which cancels the stamp by horizontal lines which extend across its face, and next imprints the date upon the face of the stamp. Trip mechanism is provided, actuated by each letter as it comes forward, by which the die is released from a detent and is clutched to the roller alluded to. It thus rotates with it, and produces the desired imprint upon the envelope. As the letter passes out, the clutch is released, leaving the die loose, and at the same time a stop mechanism is operated, locking the die in a position so that it cannot print. The next envelope that comes along releases the stop, throws on the clutch, so that the die rotates sufficiently to produce its imprint upon the envelope, and is immediately unclutched and locked. The envelopes then pass on to a stacking table, where they drop down before fingers carried by a rotating shaft that continually feed them forward against a board placed at any position desired. A register, H, indicates the number of letters which have been canceled, and is one of the most convenient accessories of the machine. The date and hour in the die are changed by hand.

The machine is driven by a one-quarter horse power electric motor, but can be run by foot power like a printing press. One very valuable feature of the machine is the clearness with which the date is printed upon the envelope. The hand stamp imprint inevitably lacks clearness, but in the machine we are describing the impression is produced with the distinctness of printing. The clerk in attendance watches for envelopes which have the stamp upon the wrong corner, or that have a number of stamps on them, and by feeding them upon other than the top edge secures the canceling of the stamps. The feed rollers are held to their places by elastic bearings, and elastic coiled spring belts are used for driving them. Thus the rollers can be pulled apart to a considerable extent, and there is no danger of the attendant getting his fingers caught or being injured in any way.

A Formidable Old Dragon.

In a paper read last November, before the National Academy of Sciences, Prof. O. C. Marsh describes the skull of the gigantic Ceratopsidæ, the remains of which are found in the Rocky Mountains.

The geological horizon of these strange reptiles is a distinct one in the upper Cretaceous, and has now been traced nearly eight hundred miles along the eastern flank of the Rocky Mountains. It is marked almost everywhere by remains of these reptiles, and hence the strata containing them may be called the Ceratops beds.

The skull of *Triceratops*, the best known genus of the family, has many remarkable features. First of all, its size, in the largest individuals, exceeds that of any land animal, living or extinct, hitherto discovered, and is only surpassed by that of some of the Cetaceans. The skull, the type of the species, is that of a comparatively young animal, but is about six feet in length. The type of *Triceratops horridus* was fully adult, and probably an old individual. The skull, when complete, must have been over eight feet in length. Two other skulls, both nearly perfect, now under examination by the writer, fully equal in bulk the two already described, and other similar specimens from the same horizon maintain equal average dimensions.

Another striking feature in the skull of this genus is its armature. This consisted of a sharp cutting beak in front, a strong horn on the nose, a pair of very large pointed horns on the top of the head, and a row of sharp projections around the margin of the posterior crest. All these had a horny covering of great strength and power. For offense or defense, they formed together an armor for the head as complete as any known. This armature dominated the skull, and in a great measure determined its form and structure.

The skull itself is wedge-shaped in form, especially when seen from above. The facial portion is very narrow, and much prolonged in front. In the frontal region, the skull is massive, and greatly strengthened to support the large and lofty horn cores which formed the central feature of the armature. The huge, expanded parietal crest, which overshadowed the back of the skull and neck, was evidently of secondary growth, a practical necessity for the attachment of the powerful ligaments and muscles that supported the head.

THE *Northwestern Railroader* learns that a large railroad company has the plans for a three-story freight house in Chicago, nearly 300 feet long, and will run cars on a track and by hydraulic lifts raise it to the second story and then run a second series of cars on second track and raise that to second story. Terminal ground is certainly getting valuable, and railroad managers will watch with interest to see three trains being loaded or unloaded at one time into a freight house from the same side. If the plan proves feasible a great saving of ground rent will be rendered to all railroads terminating in large cities.

LABORS OF THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES.

The first meeting of the General Meter Conference was held at the pavilion of Breteuil (St. Cloud Park), from the 24th to the 28th of September, 1889. The mission of this conference was to sanction the labors of the International Bureau of Weights and Measures, and to receive the metrical prototypes designed for the subscribing States of the meter convention. It consisted of the International Committee of Weights and Measures, of the French section of the Meter Commission, and of the diplomatic or scientific delegates of the States represented in the reunions of 1872. The president of the Academy of Sciences was the president of it *de jure*. The Minister of Foreign Affairs, desirous of showing the great interest that the government took in this conference, opened the first session himself.

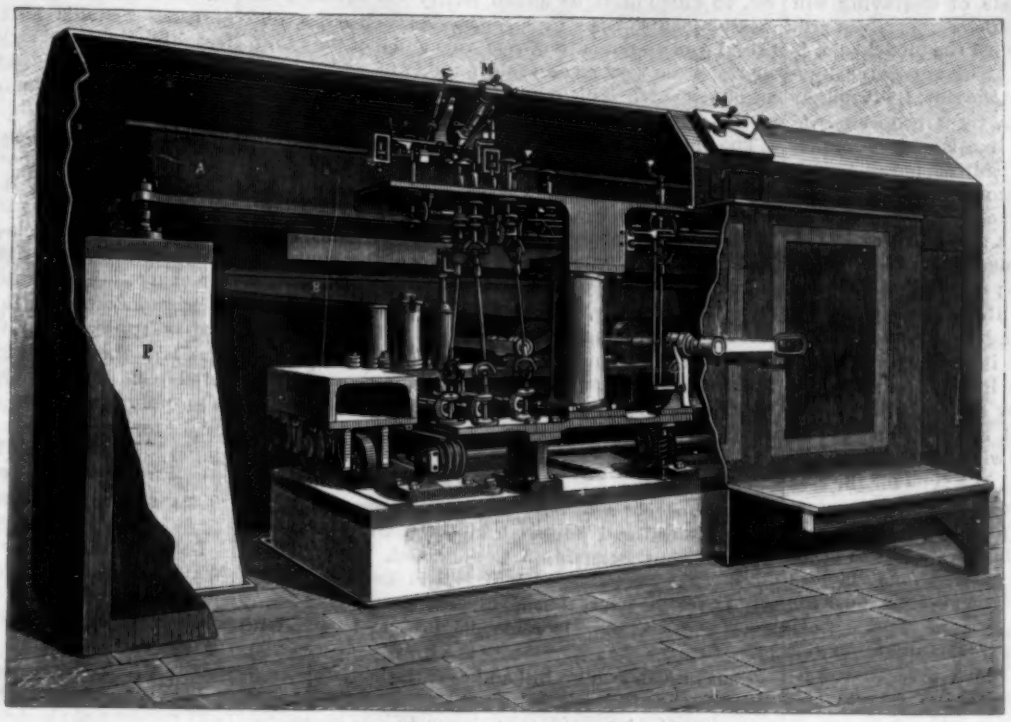


Fig. 4.—UNIVERSAL COMPARING MACHINE.

We shall say but little of the conference itself, of which we might give a pretty accurate idea by merely reproducing the speeches that were delivered. It was at the second session that the prototypes received their official sanction, and were distributed by lot among all the States. The international meter and kilogramme, so exact copies of those of the Archives that it is impossible to detect the direction of their errors, were placed in a strong box, situated in a deep cellar closed by three locks, whose keys were respectively in the hands of the director of the bureau, of the president of the committee, and of the guardian-general of the Archives. The extraction of these standards by an officer of the International Bureau was, therefore, subordinated to the authorization of the International Committee and the French government. It could take place only in the presence of the depositaries of the various keys. These precautions, which at first sight seem to be a little excessive, were necessary in order to give all the States the absolute guarantee that the fundamental standards of the metrical system should run no danger of being injured by ill-disposed or careless persons.

As we have said, the mission of the conference was to sanction the labors relative to the new prototypes of the metric system. We propose to pass these various labors rapidly in review.

It will be remembered that the Meter Commission, renouncing the primitive and theoretic definition of standards, decided simply to copy the meter and kilogramme of the Archives in their present state. The problem was, therefore, reduced to the making of these copies, then to the getting up of immutable standards for the States, and to the determining of their exact value.

The selection of the metal was a subject of profound discussion. The material for the meters and kilogrammes had to be very hard and unchangeable with time, not attackable by atmospheric agents and by ordinary chemical agents, and very refractory, in order

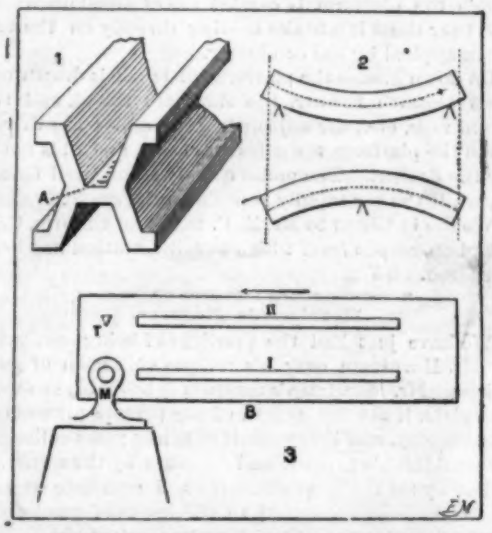


Fig. 1.—STANDARD METER. Fig. 2.—FLEXION OF THE RULES. Fig. 3.—DEVICE FOR GRADUATING THE METER.

to resist even the temperatures that might accidentally occur in the fire of a laboratory.

The important labors of H. Sainte-Claire Deville led to the adoption of an alloy of platinum and iridium (the latter in the proportion of 10 per cent). This metal is extremely hard; its resistance verges on that of steel, and its temperature of fusion is that of dazzling white (according to Mr. Violle, 1,775° for platinum and 1,950° for iridium).

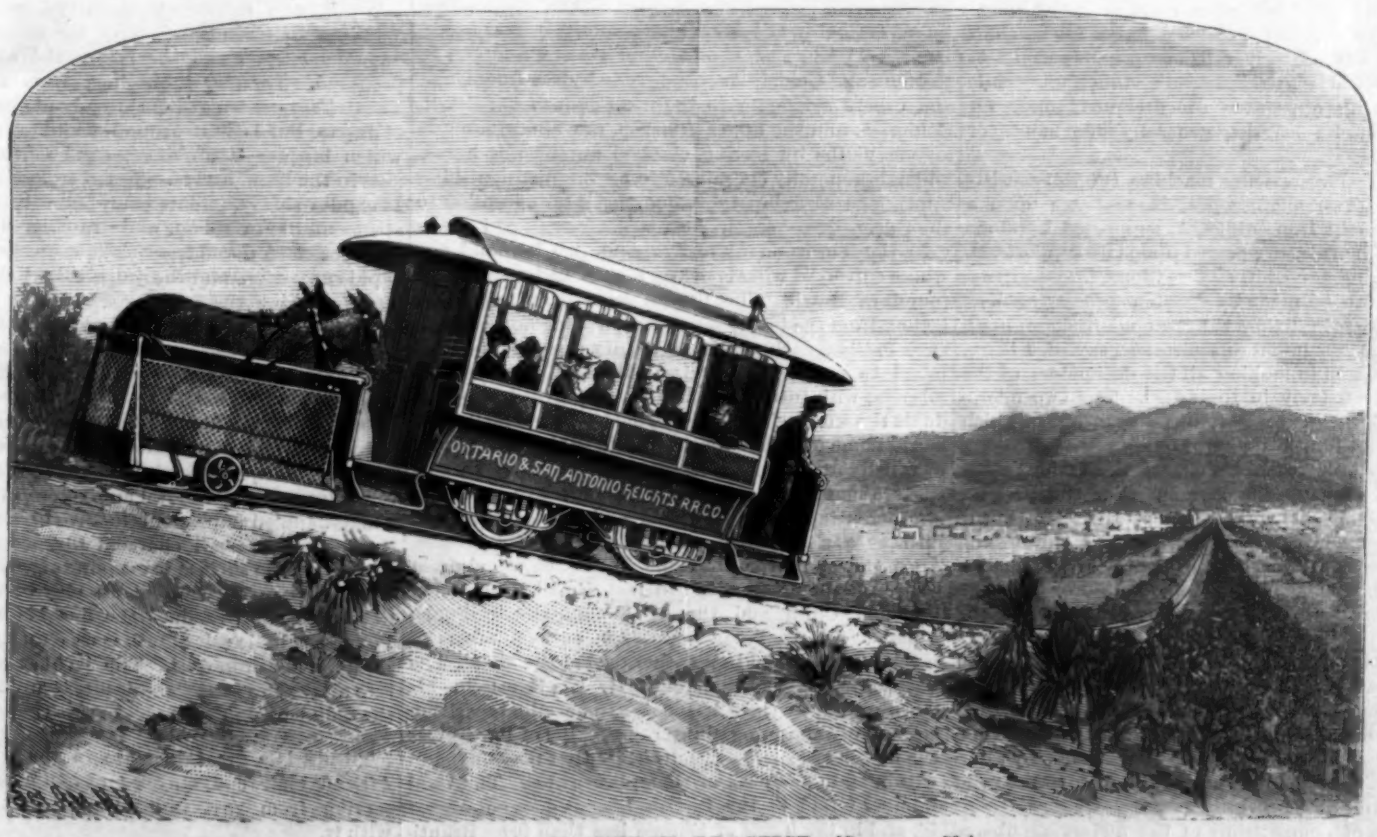
The metal necessary for the construction of the metrical standards was ordered from Messrs. Johnson, Matthey & Co., of London, who, after long researches, succeeded in purifying it. The difficulties of separating the last traces of rhodium and iron from the iridium were, says Mr. Matthey, almost insurmountable. It took no less than eleven consecutive analyses, the result of which was not declared satisfactory till October 18, 1885.

The hardness of the metal, which is an important quality for the construction of standards, rendered the manufacture of them particularly difficult; it was necessary, from the lessons of experience, to modify the tools employed for planing metals. Finally, after numerous experiments, the first rule was delivered in April, 1886.

The rules have the form shown in Fig. 1. This form, which is odd, at first sight, has been so calculated by Mr. Tresca that the distance of the divisions limiting the meter and engraved upon the surface, A, are independent of the support of the rule. Fig. 2, in which the flexions are purposely exaggerated, shows that the upper surface of a rule elongates or contracts according as it is supported at the center or at the ends. The median line, called the surface of neutral fibers, remains sensibly invariable. The X-shaped standard has been so calculated, moreover, as to effect as much saving as possible in the very costly material.

Most of the old standards of precision are very delicate and can be handled only with the greatest care, if it be desired to prevent permanent distortions; the new ones, on the contrary, are exceedingly, strong, and are capable of undergoing shocks without danger. Accurate experiments have shown that a weight of forty kilogrammes can be suspended from the middle of an X-shaped meter without permanently modifying it.

The rules, delivered in a crude state by Messrs. Johnson, Matthey & Co., were finished and cut to the length of 102 centimeters by Messrs. Brunner Bros., of Paris. Then they were polished and engraved at the Conservatoire des Arts et Metiers. A beginning was made by polishing a space near each extremity, and then the rule was placed in a horizontal comparing apparatus, where it received the two lines defining the meter, and each accompanied with two other lines at half a millimeter from the central line. Thus there was obtained, at the same time with the metric standard, the micrometric standard, under the form of two millimeters.



A NOVELTY IN TRAMWAY PRACTICE.—[See page 58.]

A brief description of this mode of engraving will doubtless interest some of our readers.

Upon a board, B (Fig. 3), is placed the model rule, I, and the rule to be engraved, H. The apparatus having been adjusted, the first line of the rule, I, is brought under the microscope, M. Then, by a proper movement of the diamond graver, a line is marked upon the rule, H. The board is then shifted parallel with the axis of the rules, until the second line of the rule occupies in the microscope exactly the position in which the first was found; then a new line is engraved upon H, and so on. The entire engraving is done without the operator seeing his work; it is not until he has finished it that he can examine it. The least defect necessitates the entire work being begun over again, for, in view of the precision that it is necessary to expect, it is impossible to *mend* an interrupted division. This difficult work, performed by Mr. Gustave Tresca, has succeeded in an unexpected manner; one of the first meters engraved, compared with the standards at the International Bureau, served as a type for the rest of the operations. Now, among the thirty meters thus engraved, there is none whose equation reaches 3*u* (three thousandths of a millimeter), and the mean of all is exactly equal to the International meter; whence we conclude that there was no systematic error in the instruments.

We shall not expatiate upon the manufacture and adjusting of the kilogrammes, which presented difficulties of another nature, and not so great. The iridium-platinum cylinders that served for this were strongly compressed in a powerful apparatus in order that all the small internal cavities might be crushed. The movement of the density shows the continuity and, within certain limits, the purity of the metal.

While awaiting the delivery of the standards, the Bureau occupied itself with the elaboration and improvements of the methods of comparison. The first apparatus, which were quite imperfect, were partially replaced with those which have already been described; and others completed the collection.

A long series of comparisons had put the Bureau in possession of provisional standards of the meter and kilogramme, whose equations with respect to the standards of the archives were exactly known. But it was still necessary to determine a certain number of copies for the labors of the Bureau, to measure their expansion, and to get up standards of the subdivisions of the meter and kilogramme. On this subject a few words of explanation may not prove amiss. To speak only of the measurements of length (the same reasonings and nearly the same processes are applicable to the masses), we may say that although there exists in the world *one* meter exact by definition, it cannot be pretended that we have a perfectly accurate single decimeter, centimeter, or millimeter. Remaining within the limits of practice, we can assert that, in a well divided meter, there are but very few millimeters whose error is less than the limit of the errors of observation.

If we desire to find the error of a millimeter, we begin by comparing the divided meter with the meter exact by definition. Afterward, on comparing the decimeters with each other, we ascertain the excess of each of them over their mean, and, consequently, the error of each separate decimeter. Afterward, by an analogous process, we pass from decimeters to centimeters, and from centimeters to millimeters. This operation, which we are describing in a few words, takes nearly a year of assiduous work. It may be done by means of an instrument called a universal comparing machine—called universal because it permits of measuring all the lengths between certain limits, while most comparing apparatus are designed solely for measuring definite lengths, generally one meter or several meters.

The universal comparing machine (Fig. 4) consists essentially of two microscopes, M, movable upon a very massive cast iron bridge, A, supported by stone pillars, P. The rules are placed upon two supports, B, capable of being moved in all directions.

The tests can be made by different processes. The simplest consists in fixing the two microscopes upon the bridge at an invariable distance, say of 1-10 m., for example, and in making all the decimeters of the rule pass successively in their field. The two microscopes thus form an optical compass by means of which each decimeter is measured separately.

We shall speak further along of the various other labors undertaken by the Bureau. For the present, we wish to terminate what concerns the study of the prototype standards designed for the subscribing States. Here again we shall speak only of the meters, of which thirty have been delivered. For the kilogrammes, forty in number, the principle of the methods of comparison was exactly the same.

The standards were designated by numbers, arranged upon horizontal and vertical lines. Each standard was then compared with all those of the same horizontal line and of the same vertical column. Each comparison of two meters was made four times, by alternately placing one end of each of the rules to the right and left of the observer.

The series of comparisons of the meters numbered 784, to which must be added nearly 400 series for the measurements of the expansions. As each series comprised 6 measurements of one rule and 5 of the other, we reach the very respectable number of about 13,000 measurements. This required an uninterrupted labor of two years.

The measurements were made independently by several observers and by means of various apparatus. Their variations therefore give a good criterion for the accuracy of the same. They also indicate the limit that it is now possible to obtain. A profound study leads to the admission that the errors of the equations scarcely exceed 0·2*u* (two ten-thousandths of a millimeter) for the rules, and are certainly less than 0·01 mg., for the kilogrammes. The accuracy of the weighings, greater than one hundred thousandth, or to a magnitude corresponding to 10 centimeters upon the terrestrial quadrant, is the greatest of all that can be obtained in physical measurements.—*La Nature.*

A NOVELTY IN TRAMWAY PRACTICE.

We illustrate a novelty in tramway practice, taken from the railroad operated in the beautiful town of Ontario, San Bernardino County, Cal. The railway passes through the middle of Euclid Avenue, a broad and beautiful street, bordered with orange and lemon trees. The avenue is some 6½ miles in length, with heavy grades as it approaches the hills.

The car is drawn up hill and over the levels by a pair of mules, but in going down grades the mules ride and the car moves by gravity, as shown in our engraving. A platform with folding sides is provided, which is supported near one end upon a pair of wheels. The opposite end of the platform is supported on the car. When the mules are the tractive power the sides of the platform are folded down and the whole rolls back under the bottom of the car, where it remains and is drawn along the track with the car. The wheels on which the platform is carried are of small diameter, and near them is a brake bearing directly on the rail when applied by the conductor.

On down grades the platform or truck is drawn out from beneath the car, the sides are raised, and the guard rails, etc., are adjusted. The mules are driven upon the platform, the gates are closed, and all is ready for the descent. The mules quietly stand, well fenced in, while the car rapidly runs down the grade.

We are indebted to Mr. E. P. Slater, of Ontario, Cal., for photographs from which our illustration has been prepared.

Horniman's Museum.

We have just had the privilege of being conducted by Mr. Horniman over his unique collection of curiosities. Mr. Horniman's museum is probably the most complete, if not the largest, of any private museum in the country, and is the result of thirty years collecting at considerable expense and diligence by the owner.

But by far the most extensive and complete section of the museum is devoted to specimens of beetles and butterflies (Coleoptera and Lepidoptera), of which there are over 12,000 specimens, in 500 drawers, and South America is in this section exhaustively illustrated.

South America is particularly celebrated, not only for the abundance but also for the surpassing beauty of its insect fauna, among which may be mentioned the huge silk-producing moths of Brazil, belonging to the genus Attacus (allied to the Indian Atlas moth) and Polythysania; the hummingbird moths, Calliomina, Enyo, etc., also the true hawk moths, Chœrocamp, Pachylia, Philampelas, and other genera common in Panama and Colombia. Castina endesmia from Chili, and others belonging to the same genus from Brazil, Colombia, and the upper Amazon, are almost unique among moths by having clubbed antennæ or horns, which is generally considered to be the distinguishing appendage of a butterfly, but this is an exception to the rule.

In the Thrysana (night-flying moths) is found one whose spread of wing is nearly eleven inches. This is found in Brazil. The beetles from Brazil alone are legion, from the lovely longicorn or long-horned beetles, Psalidognathus, whose beauty can only be compared to monstrous jewels, to the little curious Cosmisoma, with tufted legs and horns. Brazil also produces the wonderful beetle, Dynastor, Hercules (an old world name for a new world insect), the back or thorax of which in the males is lengthened out into a horn or spear about four inches long, underneath which is another attached to the head and movable, the two forming a weapon resembling the claw of a lobster. Then there are the Diamond beetles, so called from their exceeding brilliancy; in fact, Brazil, Nicaragua, Panama, Chili, and the other countries in South America all combine to produce such numbers of species as are found in no other part of the globe. The butterflies are as numerous. H. W. Bates, in his "Naturalist on the Amazons"—a charmingly written account of a charming country—speaking of Para, gives the number of species of butterflies that may be found within an hour's walk of that place as 700. The total number found in the British Islands does not exceed 66, and in the whole of Europe less than 400. Beautiful Heliconias throng the paths in the woods, while the gorgeous metallic blue Morphas soar aloft, scores of feet high, in the bright sunshine, the reflections of whose iridescent wings may be seen afar off—some say a mile—and the hummingbirds add to this scene of enchantment.

The museum is open to the public, on Wednesday and Saturday afternoons, by cards of admission to be had from Mr. E. D. Watkins, the genial curator, 100 London Road, Forest Hill; and Mr. Horniman permits also natural science classes, or parties interested in the works of nature and art, to go over the museum under the charge of the curator. It is, however, necessary to arrange beforehand, in order that a convenient time may be appointed for the visit. South American visitors, and those from India, would be peculiarly interested in the collection, as the fauna of those continents is so well represented.—*Chemical Trade Journal.*

DECISIONS RELATING TO PATENT CASES.

Supreme Court of the United States.

WATSON *vs.* THE CINCINNATI, INDIANAPOLIS, ST. LOUIS & CHICAGO RAILWAY COMPANY.

Letters Patent No. 203,226, granted to Chauncey R. Watson, April 30, 1878, for improvement in grain car doors, *Held* to be void for want of patentable novelty if construed to consist of the combination, in a freight car having an outside rigid door, of an inner flexible sliding grain door.

Where the complainant's door was carried on rods and staples and the defendant's door moved in grooves, *Held* that even if there was no material difference between the doors of complainant and defendant, respectively, there was no infringement, for complainant had in effect disclaimed defendant's door.

A patentee will not be permitted to say that certain specified elements of his combination claim are not essential to the combination.

An alleged combination which consists in a mere aggregation of parts, each to perform its separate and independent function substantially in the same manner as before combination with the other and without contributing to a new and combined result, is not patentable.

Trade Marks.

Superior Court of Cincinnati—State of Ohio.

HOEB *et al. vs.* BISHOP *et al.*

A small metallic frame containing a portrait fastened to a pin, so as to be used as a personal ornament, does not constitute a valid trade mark when so attached to and sold with a cigar as to be readily detached and used separately in the manner indicated.

An article having a distinct commercial value of its own cannot be made a trade mark for another article by being attached to and sold with it.

Where it is charged that the defendant has imitated the packages of the plaintiff for the purpose of imposing the goods of the former upon the public as those of the latter, not only must the fact of imitation be shown, but it must also appear that the imitation was made with intent to impose upon the public as aforesaid, and such intention may be presumed from the fact of imitation, but the presumption is not conclusive, and may be overcome by facts showing that the imitation was for other and innocent purposes.

Japanese Lacquer.

Mr. Romyn Hitchcock described recently to the Washington Chemical Society the manner in which Japanese lacquer and the beautiful Wakasa ware are prepared. Lacquer is obtained from a tree, *Rhus Vernicifera*, which grows throughout the main island of Japan, but is best around Kioto. The juice, from which lacquer is obtained, exudes from horizontal cuts in the bark, and is collected from May to October. It exudes slowly, and is collected with a pointed instrument like a spoon, and transferred to a wooden receptacle. A dozen trees are cut in several places in rapid succession, and the juice collected from time to time. During the season each tree is visited about twenty times. As the sap first exudes it is a grayish white, thick or viscous fluid, which quickly turns to yellow, and afterward to black, when it is in contact with the air. It is strained through a cotton cloth to free it from wood and dirt, being first thoroughly stirred to make it of uniform consistency. A portion of the raw lacquer, usually about 16 lb., is then poured into a large circular vessel and vigorously stirred with a long-handled implement for five or six hours, while the heat of a small charcoal furnace is ingeniously thrown on the surface to evaporate the water. During the stirring certain ingredients may be added. Thus, iron is added to produce the fine black lacquer. In Tokio, a soluble salt of iron is used for this purpose; in Osaka, a fine iron dust. The lacquer is then poured into a vessel to settle, and is afterward drawn off from the sediment.

THERE is a great increase in the consumption of African teakwood, on account of its property of preserving from rust iron or steel that is in contact with it.

The Production of Pumice Stone.

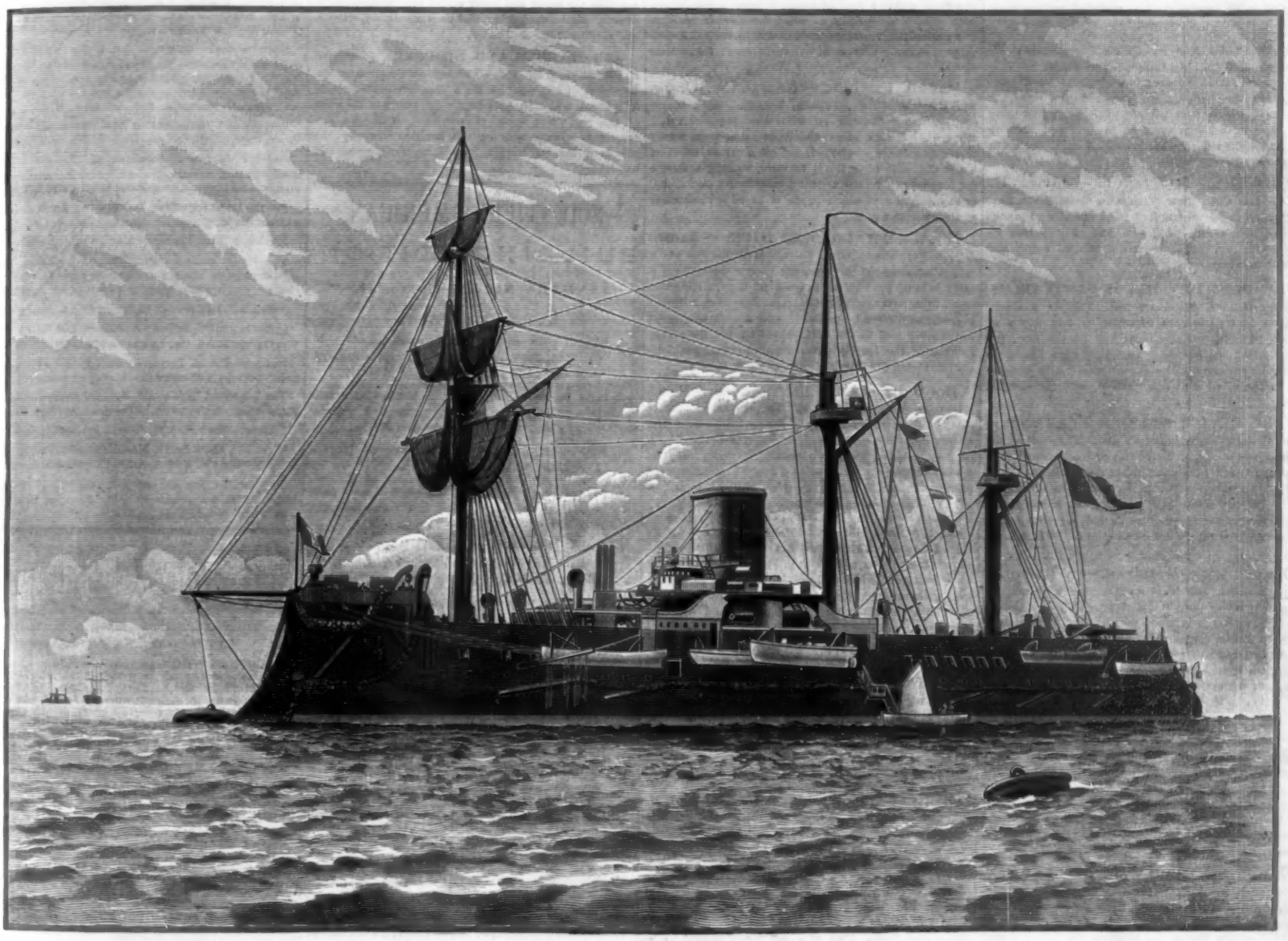
We often hear it remarked, and particularly after an eruption of a volcano, that pumice stone ought then to be plentiful and cheap, as quantities must have been ejected during the volcanic disturbance. As a matter of fact, however, none of the white stone in general use is obtained from active volcanoes. It is true that Vesuvius has ejected pumice stone, for at the time when Pompeii was destroyed large quantities fell over the doomed city, but that pumice appears to have been only of diminutive size, and is gray in color, and of the same inferior character as that found to the north of Naples. It is also probable that volcanoes situate in the southern seas emit pumice, for accounts are published now and again of vessels sailing through quantities stretching for miles upon the surface of the water. This, presumedly, is similar to that taken from the sea near the Italian shores. It is small in size, and in the form of pebbles, having been rounded by the action of the water.

As already stated, we are not indebted to ejections from volcanoes for our supply of stone. It is to actual deposits of the article discovered in one or two quarters of the globe, the best of which is at present to be found in the island of Lipari, situate in the Tyrrhenian Sea. The island is of no general interest, and is scarcely visited at all by any but Italians engaged in trading in its productions, such as currants, capers, wine, and pumice. It is mountainous in character, and consists of tuffs and lavas and of highly siliceous volcanic products. The district where the stone is found is called Campo Bianco or Monte Petalo (1,500 feet above the level of the sea). It is an interesting ride there upward from the town. The views obtained of land and sea during the ascent are very fine, and the effect produced by the first sight of the pumice deposit curious, for after riding a considerable distance, partly along precipitous paths, sufficiently dangerous to be interesting, and partly through vineyards and over grassy plains, one almost suddenly comes upon a seemingly snow-clad narrow valley inclosed by hills, also quite white, and the whole glaringly bright on a sunny day, such as can be experienced in this southern latitude. Into these hills workmen are ceaselessly digging deep burrows, working within by candle light. In their excavations they come across many lumps of pumice stone, which are placed in baskets, subsequently being conveyed along the valley to the seashore, where small boats are loaded and sailed to the seaport near by, where the stone is sorted, packed, and shipped to distant parts either *via* Messina or Leghorn.

Some years ago it was almost the general custom to send the stone loose in the vessels to the Leghorn merchants, who sorted and packed it for shipment. This custom, however, has been altered, and by getting the stone sorted at the place of production, far better results have been obtained than formerly. There is no doubt but there is now less good stone to be found than used to be the case. For one ton of good light stone a miner has to have many tons of inferior quality to dispose of, and now that prices have been so interfered with by the operations of the syndicate that has been formed to acquire the working of the principal portion of the mines from the municipality, it has become a question of paying a very high price for stone we could formerly obtain for far less than it now costs.

THE FRENCH WAR SHIP "REDOUTABLE."

The "Redoutable," one of the ships in the French squadron of evolution at Toulon, was constructed in 1876. She is built of iron and steel, 318 feet 2 inches long, and with 64 feet 8 inches breadth of beam, having a displacement of 9,200 tons, and drawing 25 feet 6 inches water. Her engines are 6,071 indicated horse power, working twin screw propellers, and giving a speed of 14·66 knots an hour. The coal storage is 510 tons, sufficient for steaming 2,800 miles at 10 knots an hour. The hull is protected by a belt of armor plate 14 inches thick, and the central battery has 9 inch plate armor, with 15 inch backing. The guns in the central battery are eight breech-loading 24 ton guns, with caliber of 27 centimeters diameter, rifled; and the barbette guns are six 3 ton guns of 14 centimeters bore. She carries also twelve machine guns and four torpedo tubes.—*Illustrated London News.*



THE FRENCH IRONCLAD "REDOUTABLE."

TELEPHONES and speaking tubes are of greater antiquity than most persons are aware. The speaking tube is a contrivance mentioned in ancient writers, and comes down to us or survives just as candles and oil lamps have not been altogether superseded by gas and electricity. In 1667 Robert Hooke, of London, described how he transmitted sound by means of a wire to considerable distances. Wheatstone described his "telephone" in 1821, and in 1854 Ch. Bourseul said: "Suppose a man speaks near a movable disk, sufficiently pliable to lose none of the vibrations of the voice, that this disk alternately makes and breaks the currents from an electric battery, you may have at any distance another disk which will simultaneously execute the same vibrations. It is certain that in a more or less distant future, speech will be transmitted by electricity."

Pyorrhœa Alveolaris.

This is an insidious disease which begins by a deposit of tartar upon the necks of the teeth and gradually creeps in, reaches the roots, clinging to the exterior thereof. The teeth become loose, painful, and extraction is often deemed necessary. But some dentists are successful in effecting cures. Some treat the disease by introducing scraping instruments, thereby removing as much of the tartar from the roots as they can; then injecting sulphuric acid or peroxide of hydrogen, followed by alkali and an antiseptic. At a recent meeting of the New Jersey State Dental Society, Dr. James Truman, in the course of some remarks upon the subject, said:

"Does it originate from tartar? Not if I understand it. When you take a patient in hand who states that in the morning when he brushes his teeth the blood will ooze from the gum, you know what the condition is. Here and there a tooth will present a bright red line at the border line of the gum. The moment that it is touched blood will ooze from it, by the disturbance of the capillaries at that point. That is the beginning. And if you take it in hand at that stage, you can stop pyorrhœa alveolaris. It has nothing to do with tartar. It may come from constitutional disturbances; it may come from some form of nephritis or a long siege of sickness. What then follows necessarily after this? Immediately succeeding we have a development of micro-organic life. When you place a rubber dam, or a clamp, or ligatures upon teeth, you produce irritation, and the patient will complain. You take off the instrument, and you allow the patient to go away without any treatment whatever. In forty-eight hours there will be a development of micro-organisms, and pain will result, and irritation at the neck of the tooth, and if it is not stopped at that time, it may go on until this pathological condition which we call pyorrhœa alveolaris appears.

"I hold that no dentist should put a rubber dam in the mouth, or a clamp on the teeth, or do anything of that kind liable to raise inflammation at the necks of the teeth, without applying an antiseptic. For this purpose I know nothing better than sulphate of quinia, mixed into a paste—not because it is the best germicide, but because it is more lasting than other agents."

A PERMANENT and durable joint can, it is said, be made between rough cast iron surfaces by the use of mineral asbestos mixed with sufficient white lead to make a very stiff putty. This will resist any amount of heat, and is unaffected by steam or water.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—John Bender, Marion, Kansas. Combined with the drawhead is a coupling hook pivotally connected thereto, a weight arranged in connection with the hook, a jaw being pivotally connected to the drawhead and a plate mounted within a recess in the jaw, and links by which the jaw and plate are connected, with various other novel features.

Mechanical.

NUT LOCK.—Isaac S. Humbert, Staunton, Va. The bolt has an integral thread and the nut has a transverse groove in its threaded portion, the bottom of the groove being curved, and in connection therewith is used a transversely wedge-shaped and longitudinally curved and tapered key having a hardened or steel body, a soft tip, to adapt it to cut the bolt thread and clasp in the nut groove.

JOURNAL BOX. — Ezra L. Post, New York City. This invention covers a bearing provided with a continuous series of anti-friction rolls, a roll-holding attachment, and radial anti-friction rolls, making a bearing designed to operate with a minimum amount of friction, and one in which the parts are so arranged that very little friction will be produced at times when the journal shaft is revolving and the bearing is subjected to side thrust.

SAW SWAGING MACHINE. — Henry P. O'Connor and Antoine Leduc, Manistee, Mich. This machine has two side disks and a handle between them, the latter fulcrumed on a shaft secured on a plate, the construction being such that the tooth during swaging is engaged on all four sides, on the top and back by dies, and on its sides by flanges which limit the tooth point to the desired width.

PUG MILL ELEVATOR. — James H. Steele, Butte City, Mon. This is an elevator for conveying mud to the mud mill of brick machines, the conveyor slightly compressing the mud as it passes up from the hopper, and clearing the mud of stones and other hard substances.

CLAMPING DEVICE FOR SAW TABLES. —Joseph Baisley, Seymour, Ind. This is a clamp designed to be instantly adjusted to any width of lumber, to hold it while being cut by the saw, the slotted saw table having a stationary edge flange, in connection with grooved guideways, a stop with recessed base, a chain, with sprocket wheel, shaft, and hand lever.

FEED DEVICE FOR ORE FURNACES.—Albert C. Johnson, Wilmington, Del. The shell of the furnace has openings in its top and a hopper whose openings are out of alignment with those in the top of the shell, there being apertured gates between the shell and the hopper, and means for alternately reciprocating the gates, whereby the ore may be fed regularly to the furnace and the supply cut off as soon as the furnace is stopped.

DRILLING MACHINE. — William H. James, Pittston, Pa. This machine has a rectangular frame with an opening in one of its end bars, a sliding crosshead in which is swiveled a socket, an internally threaded guide ring and a threaded feed bar, with means for operating it, and other novel features, the machine being designed for boring out charge holes in rock, etc., while not being heavy or burdensome.

Miscellaneous.

POCKET BOOK. — Isaac Scheuer, New York City. This pocket book has a bag with pivoted jaws and a separate and independent bag suspended from its upper longitudinal edges within the first bag, and having closed ends with folds extending above the points or pivots of the jaws and closing the end spaces between them.

CARPET FABRIC. — Joseph Jagger, Rifton Glen, N. Y. This is a new article of manufacture, consisting of a fabric having the usual warp threads binding the filling threads in place, and a third or middle warp thread for binding the filling thread carrying the pile down into place.

HALTER, YOKE, AND BRIDLE. — Peter J. Krater, St. Mary's, Mo. This is a combination device of halter and attachments, enabling one device to be used as a substantial halter or as a guard to prevent an animal jumping or breaking a fence or injuring himself thereat, while allowing him to feed and water himself freely from or at the ground, being also adapted for use as an open riding bridle or a blind driving bridle.

CLOTHES LINE PROP. — Robert McAlpine, Trenton, N. J. The pole or prop consists of two pieces of wood of suitable length, one section being notched at intervals on one side and the other section being held by clip bands to slip on the notched section, in combination with a spring dog to which is fixed a threaded stud and a nut.

CLOTHES LINE SUPPORT.—John B. and Robert Johns, Findlay, Ohio. This support consists of a shank with a head beyond which there is a spiral section, the support to be driven into a post, and obviating all knotting of the line, while providing for the ready taking up of any slack.

CLOTHES LINE. — Charles Barlow, Cookshire, Quebec, Canada. This line has a metallic core, with a spirally wound wire covering turning freely on the core, in order to lessen the possibility of the clothes being cut or torn when blown to and fro in the wind.

CLOTHES PIN. — Edward M. Watson, Jersey City, N. J. This pin is preferably made of one piece of metal wire, in the form of a head piece with three arms projecting therefrom, so made that it may be used to fasten garments or fabrics to a line without danger of tearing the fabrics in applying it, or by their being blown about by the wind.

WASHING MACHINE.—John S. Headen and John T. Boswell, Pleasant Hill, Mo. This invention consists of a fixed corrugated or fluted board and a second corrugated or fluted board adapted to slide on the first one, making an improved washboard which is simple and durable.

SCOW.—William Osborn, Duluth, Minn. This scow has compartments communicating with a suction pipe just below compartments in the bottom of the scow, valves connecting the compartments and pipe, which pipe is open at both ends, and communicating at one end with the water below the scow, to provide a simple and cheap way of unloading sand or any substance that will flow with its own gravity.

STEAM LIQUID HEATER. — John F. Bradford, Leetonia, Pa. This invention covers an improvement especially intended for use in heating tanning liquors, whereby the degree to which the liquor is heated may be automatically regulated, the highest heat being obtained by subjecting all the coils of the liquor pipe to the live steam, while by permitting the water of condensation to cover the coils to a greater or less extent, the degree of heat is lowered as the quantity of water is increased.

WAVE MOTOR.—Robert B. Davy, San Diego, Cal. This invention provides a float or buoy fixed in such a manner as to vibrate on the surface of the water within a limit of ninety degrees, in connection with suitable mechanism to retain the float in position and utilize the vibratory movements to convey a continuous running movement to a drive shaft located on shore.

PAPER FEEDER. — George W. Crane and Harry Bradshaw, Topeka, Kansas. Rock shafts are journaled beneath an adjustable paper-carrying table, with a rock shaft above the table from which elastic fingers are suspended, and connections between the shafts, with other novel features, making a device for feeding paper into a ruling machine, a perforator, or any machine to which paper is to be fed one sheet at a time from a pile.

BREECH LOADING GUN. — James Jensen, Park Place, Ark. The barrel of this gun has a projection arranged for engagement by a spring bolt, a catch holding the bolt in retracted position, a slide and catch being arranged in connection therewith, a thumb piece being carried by the slide, and a lever connected to the slide and to the bolt, providing for the secure locking of the barrels when moved to firing position, for improving the action of the extractor, etc.

BOOT OR SHOE VENTILATOR. — Peter Welander, San Francisco, Cal. This is a short tubular shell of sheet metal having a flange turned over outwardly upon one end, and the opposite end closed by a perforated plate, making a ventilator which may be readily secured in place at any desired point upon a boot or shoe, and set in open or closed position, to afford thorough ventilation of the interior.

TOE WEIGHT. — Elwood L. Gregg, Hoxie, Kansas. This weight has a dovetail or undercut groove, which a fastening bolt is formed to fit, having on its rear side a projection arranged to engage a clip, whereby the weight may be securely held to a horseshoe and conveniently applied to and removed therefrom.

EXTENSIBLE TRESTLE. — Gustav Bogusch, of Vallecillo, Mexico, and August Zincke, of Llano, Texas, administrator of Robert J. Bogusch, deceased. This trestle has a brace frame with parallel connected end bars having hook-shaped ends with set screws, and other novel features, making a strong and simple construction for a scaffolding for masons, carpenters, etc., which may be readily put together and taken apart.

BIRD TRAP.—Benjamin Walton, Compton, Cal. This is a spring trap so constructed that most of its parts may be entirely in the top part of a post or stake, but so arranged that when a crow or hawk or other birds alight on the post a spring-held catch will be released, and arms with serrated teeth will be closed over the top of the post, thus seizing the bird.

HAY STACKER. — Daniel H. Talbot, Sioux City, Iowa. This is a machine designed to be ordinarily operated by means of a team attached thereto for stacking hay, ensilage, etc., the machine being portable and capable of automatic elevation as the stack is formed, while it is designed to form a stack with but little manipulation or attendance on the part of the operator.

CORSET CLASP. — Frank B. Converse, New York City. This clasp has a catch plate with a slot that is narrow at one end and around the slot a depressed flange, the locking stud having a head rounded underneath and adapted to enter and engage the catch plate, making a clasp which may be readily fastened or unfastened even by a child.

BOOOM BRUSH BRIDLE. — John B. Butenschon, Portland, Oregon. This bridle consists of an upper and lower wire loop connected together and each having an eye for the passage of the free end of the wire, making a cheap and efficient clamp for holding the brush of a broom in form without stitching.

WINDOW CLEANER. — George Pilson, Yonkers, N. Y. This device has a brush head with a bore in alignment with a bore in a hollow handle, a receptacle with a series of apertures being secured to the head, whereby a continuous supply of water may be fed to the cleaning surface of the implement.

KNIFE CLEANER.—Joseph Thompson, Docoto, Cal. This is a household implement, designed to be simple and inexpensive, for the cleaning of table knives, the main object being to provide for the yielding support of the polishing material and the delivery of it in such quantities as may be required.

CHECK CUTTER.—Leonidas C. Pressley, Brooklyn, N. Y., and William Lambard, Wheatland, Cal. This device has a base plate with a fixed right-angled cutting edge, in combination with a right-angled knife pivoted at the ends of the plate at diagonally opposite corners, for cutting checks or other billets of various sizes from check books or sheets.

AERATING MILK. — Aldis O. Morgan and Jerome B. Gates, Hermon, N. Y. This invention covers an apparatus adapted to be readily fitted to a milk can, whereby a continuous supply of cool air may be passed through the milk for cooling it and driving off noxious volatile matters.

CABINET FILE. — John Muhlhauser, Rochester, N. Y. This casing has rigid horizontal panels loosely mounted upon one another in the casing, lugs at their rear ends pivotally connecting the panels with the casing and being vertically movable therein, making a convenient receptacle for sheet music, papers, etc.

FOLDING BED SCREEN. — John J. Griffith, San Bernardino, Cal. Combined with a frame having rubber-lined uprights and a folding top, on which a mosquito bar is secured with side flaps, are weighted pockets to hold the mosquito bar in position against the uprights and on the floor, with other novel features, the screen being one which can be readily folded up, and permitting of ready ingress to and egress from the bed.

SASH BALANCE.—John S. Headen and Coleman G. Farmer, Pleasant Hill, Mo. This is designed to be a simple, ornamental and reliable device whereby the upper and lower sashes may be arranged to counterbalance each other, and be relatively adjusted in the window frame as desired.

JUG HANDLE AND STOPPER.—Simeon L. Bray, Evansville, Ind. This is a combination device, consisting of a stopper having a transverse hole through it, through which passes a handle extending to the sides of the jug, while a bail is connected to the jug and arranged eccentrically in the handle, whereby the mouth of the jug may be closed by turning the bail handle.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1742) A. M. H. asks: Please inform me what will take wood smoke from coach windows. A. Wash with whiting and soap.

(1743) W. G. O. writes: What ingredients are looked for in sanitary water analysis? What are the best and latest books on the subject? A. Chlorine, ammonia, free and albuminoid organic matter, oxygen required to oxidize same, are the principal data sought for. We recommend MacDonald, "Water Analysis," $2.75; Wanklyn & Franklin, "Water Analysis," $2; and Austen's "Hand Book for Water Drinkers," 50 cents.

(1744) F. A. B.—The object that you send is a gall, which has been produced upon some plant by the sting of an insect.

(1745) W. S. B. writes: 1. I want to attach leather to tin without having to roughen the tin. What can I use for a cement or glue? A. As a simple preparation use a freshly made solution of gum tragacanth. It should be about as thick as butter. Ordinary glue mixed with tannic acid and at once applied, or a preparation made by soaking shellac in strong ammonia for ten days, may answer your purpose. 2. I have a lot of soluble glass with which I have mixed shellac. What can I add to make it still more adhesive to use as a cement for ordinary purposes? A. You cannot make it satisfactorily adhesive as a cement for general use.

(1746) G. A. O. asks how to construct and connect a spark coil so that with the proper gas fixtures he can light three gas jets, not at the same time, that is, so that one can be lighted without lighting the other two? A. For coil use five pounds No. 18 magnet wire wound around a bundle of iron wires one inch thick and six inches long. From one end of the coil carry three wires, from the other end carry one to the battery, thence three wires, thus making two to each burner. Use a switch or key in each line.

(1747) E. T. asks: What is the form and advantage of a bilge keel as differing from an ordinary keel, applied to a ship? A. Bilge keels, as their name implies, may be only a deep strake along each side of a vessel at the bilge, or at the most prominent point in the curve from the main keel to the water line, for the purpose of preventing excessive rolling in vessels having high centers of gravity. They increase skin friction and have a retarding effect by their curved form of line, otherwise the only advantage is to lessen the draught of the vessel, by dispensing with the center keel. They do not compensate for the loss of leeway in dispensing with the main keel. In fact, we can see no value in bilge keel except to prevent excessive rolling in overbalanced steamers.

(1748) F. K. asks: 1. What causes warm gusts of wind to come when the air is quite cold, and especially in the fall and spring just before a storm? A. In the fall, owing to dry air and rapid radiations, great differences of temperature may occur within a small area. Thus wind may carry warm air to a cool locality very quickly. When such sudden changes occur, the conditions are favorable to disturbances and storms. 2. How long will the common iron road bridge last? A. If taken care of, it will last many years. They have not been in use long enough to determine the factor of endurance. If neglected and left unpainted and unrepaired, they may very quickly go to pieces.

(1749) M. H. D. asks the process of making diamond ink for etching on glass. A. Mix sulphate of baryta with hydrofluoric acid.

(1750) J. J. asks: What cement will set quickest and firmest cast on collodion? A. Use a strong solution of collodion for above purpose.

(1751) J. L. asks: What number of wire is used to wind the magnets of an electric bell such as is commonly used? A. Use No. 24 wire.

(1752) Frank asks: Would you inform me through the columns of your valuable paper how the white ink is made, such as is used on colored paper? A. A solution of oxalic acid may be used on blue paper. Or a body ink may be made by rubbing up Chinese white with gum arabic water.

(1753) H. J. L. asks how to solidify paraffine oil. A. Solution of glue and emulsion of slippery elm bark have both been suggested as materials to mix with oil for producing a species of gelatinizing or solidifying.

(1754) A. V. F. asks: 1. How much hydrogen gas will an ordinary 1 volt average size battery set free in twenty-four hours? A. None on closed circuit, as the voltage is too low to decompose water. 2. Is there any way of electro-plating other articles besides metallic ones? A. Several ways are practiced. The simplest is to thoroughly coat the object with plumbago. A little fine iron powder may, with advantage, be dusted over the object, after applying the plumbago, if it is to be copper-plated.

(1755) A. H. R. asks: 1. How can I magnetize a needle sufficiently strong to use in a galvanometer? A. Rub it a few times, always in one direction, with the same pole of a magnet. 2. What is the best shape to use—round or flat? A. It is immaterial. 3. Will watchspring do? A. Yes. For a description of a home-made and highly sensitive galvanometer we refer you to our SUPPLEMENT, No. 628.

(1756) J. H. F. asks to be referred to paper showing how to make filter for domestic use. A. We refer you to our SUPPLEMENT, No. 451, for descriptions and illustrations of simple and effective home-made filters.

(1757) H. W. K. asks: Is there any chemical that will etch on the polished surface of patent leather? A. No such acid is known. Nitric acid or oil of vitriol would have a slowly corroding effect, but we believe no practical results can be obtained.

(1758) W. A. B. writes: I am building a wooden aquarium, and would be much obliged if you would tell me the best cement to use in putting in the glass and also the best paint to coat the bottom with to make it impervious to water? A. Use a mixture of Burgundy pitch 150 parts, old gutta percha in fine shreds 25 parts, finely powdered pumice stone 75 parts, for cement, and paint bottom with same. It must be applied hot, and a hot iron wire may be used to melt it into crevices, etc.

(1759) F. G. F.—To remove warts apply a solution of chromic acid. It will blacken them, and eventually it is said will remove them. Or touch every day with a stick of lunar caustic, first moistening the wart.

(1760) E. B. and G. F. W.—For a fusible metal resembling silver, the following alloys are more or less available:

	a	b	c	d	e	f	g
Bismuth	6	6	3	none	none	1	½
Zinc	3	none	none	none	none	none	none
Lead	13	13	1	none	80	none	½
Tin	none	3	1	3	20	100	4½
Copper	none	none	none	7	none	4	none
Antimony	none	none	none	none	none	8	½

All are parts by weight. The last two are particularly recommended as imitating silver.

(1761) E. P. is referred to the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 69, 227, and 265, for notes on celluloid. Pyroxyline, or nitro-cellulose, is ground in water to a pulp. To 2 parts by weight of dry pyroxyline 1 part of finely divided camphor is added. After thorough mixing and kneading together, the mass is placed in moulds, and is heated under pressure to a temperature of 150° to 200° F. for a sufficient time. It is left to cool under pressure in the mould.

(1762) W. I. L. says: You have been publishing very interesting articles on various subjects, but there is one very interesting subject about which I have never seen anything in your paper, and that subject is Submarine Boats. Will you kindly tell your readers something about this? A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 218 and 330, for illustrated description of submarine torpedo boats, and many others under the head, "Torpedo Boats," in our catalogue. Our literature on this subject is very full in the SUPPLEMENT.

(1763) D. H. D. asks what is used on moulds in casting lead to make casting smooth and bright. A. Moulds for casting lead are made of iron or brass, or else of sand. Pure lead does not run smooth and bright when cast. By adding a little tin, tin and antimony, or tin, antimony and bismuth, a free-running alloy can be made that will make smooth, bright castings.

(1764) J. M. asks: Will you kindly inform me as to the best way of raising water from a rapid river to irrigate level bench land about 20 to 30 feet above the river? A. In a rapid river there is supposed to be fall enough for the use of water wheels and pumps for the purposes of furnishing water for irrigating land. A dam of convenient height, a race for obtaining sufficient fall, a turbine, overshot, or breast wheel, and a pair of plunger pumps, seem all that is necessary for elevating water to moderate heights. In the absence of details as to the situation and facilities for erecting a pumping plant, we cannot be expected to give specific information.

(1765) H. Y. asks how poplar, walnut, and other woods are stained, so as to imitate cedar, in the manufacture of cigar boxes? A. They are veneered. If you will soak a piece of the box in water, the veneer will come off, disclosing the way it is made.

(1766) H. W. asks: 1. What size of wire should be used for a bell, to be operated by one Leclanche cell? A. No. 24. 2. How long should the cores be? A. One and one-half inches. 3. How thick? A. Three-eighths of an inch. 4. Will cast iron do for the cores? A. They should be made of wrought iron. 5. If soft iron is heated and hammered to fit, will it injure the magnetic property? A. The iron should be annealed after working. 6. What should the armature be—steel or soft iron? A. Soft iron. 7. Should the current start from the positive pole, through the electro-magnet, then to the negative, and back to the battery? A. It makes no difference which way the current runs through the magnet. 8. What size should the conducting wire be that runs from the battery? A. No. 18. 9. Will cast iron make as good electro-magnet as malleable iron? A. Soft gray cast iron makes a fair electro-magnet. It is probably better than malleable iron, but is not so good as wrought iron. 10. In what number of your paper are there directions for making induction coil? A. You will find information on the construction of induction coils in SUPPLEMENT, No. 160. 11. How long should the wire be for the bell mentioned in the beginning of the letter? A. The depth of the winding on the bell magnets should be equal to the diameter of the core.

(1767) W. A. M. asks: 1. Is there a writing fluid of any color other than black or red that will stand? A. Yes; you will find many inks described in our SUPPLEMENT, No. 157. 2. Will you kindly give recipes used for preparing inks suitable for use in shading pens? A. Make a solution of gum arabic of sufficient thickness, and color with aniline previously dissolved in a little alcohol.

(1768) Zero asks: 1. What is gum salt? A. Gum salt may be a name for crude rock salt. 2. What is rock alum? A. Alum in large crystals. 3. What is white vinegar? A. Vinegar that is destitute of color, generally supposed to be made from white or colorless wine. 4. There is a spring of magnetic water in Chardon, O. What is the cause of its being magnetized? A. There is no such thing as magnetized water. 5. Where can I procure a catalogue of locomotives? A. You will find many locomotives described in the SCIENTIFIC AMERICAN and SUPPLEMENT. 6. If we had a boiler with 40 lb. steam in it, and should pump in a 100 lb. air pressure, keeping the heat the same, would it condense the steam? A. If the water were kept at the same temperature, the steam would for the most part condense. You must supply page reference for your other query.

(1769) W. P. writes: 1. Could you tell me the composition of a blacking which, when applied to leather, retains its brilliancy for a length of time without a second application? A. See query No. 1704. 2. I have a large quantity of paint scrapings from pots and kegs, etc. How can I reduce them and use them over again for a priming coat? A. Grind them in a paint mill with oil.

(1770) K. McI. says: I have seen it asserted that the Mississippi River runs up hill through its lower course. I have no doubt you are conversant with the statement and the reasons given therefor. At the present I find it very difficult to understand how this can be, since nothing can recede to a position further from the center of the earth than that which it at first occupied without some impulse which totally overcomes the influence of gravity. Now, as is well known, centrifugal force does not decrease the weight of a body to any considerable extent at the equator. Therefore, it appears to me very difficult to comprehend how the Mississippi can run up hill. A. Centrifugal force does decrease the weight of a body at the equator; 195 pounds at the equator is about equal to 194 pounds at the poles, as far as weight is concerned. The earth is nearly an oblate spheroid. The distance from the surface to the center at the equator is about 3,962 miles, while from the surface at the poles to the center is about 3,949½ miles, the polar surfaces being depressed 12½ miles below the surface of a perfect sphere of the diameter of the earth at the equator. A simple computation shows that the mean surface of the earth at New Orleans is nearly 600 feet farther from the center of the earth than at Cairo. At the same time the gravity slope of the Mississippi from Cairo to New Orleans, a distance of about 1,000 miles by the way of the river, is about 2·8 inches per mile at mean water, or 233 feet that it runs *down hill* from Cairo to New Orleans with a gravity datum, but it recedes in so doing 367 feet from the center of the earth, which in one sense may be considered up-hill.

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To Engineers and Contractors.—OFFICE OF THE LIGHT-HOUSE BOARD, Washington, D. C., January 9, 1890.—Proposals will be received at this office until 12 o'clock noon on Tuesday, the 1st day of July, 1890, for the design, the specifications, the complete construction and equipment, and the temporary maintenance of a light-tower on Diamond Shoal, off Cape Hatteras, North Carolina. By an Act of Congress the total cost of the light-station shall not exceed the sum of $500,000. Specifications embodying the requirements of the structure, forms of proposals, and other information may be obtained on application at this office. The right is reserved to reject any or all bids and to waive any defects.
DAVID B. HARMONY, *Rear-Admiral U. S. N., Chairman.*

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